A paper prepared for the

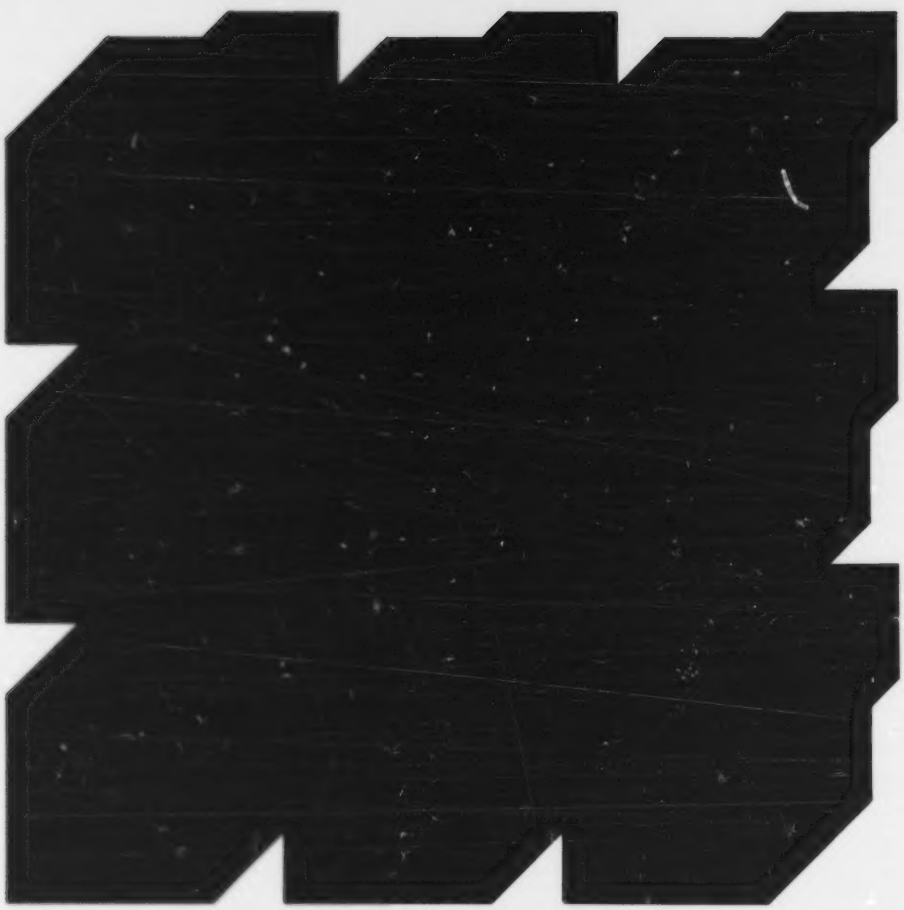
Economic Council of Canada

P.O. Box 527
Ottawa, Ontario
K1P 5V6

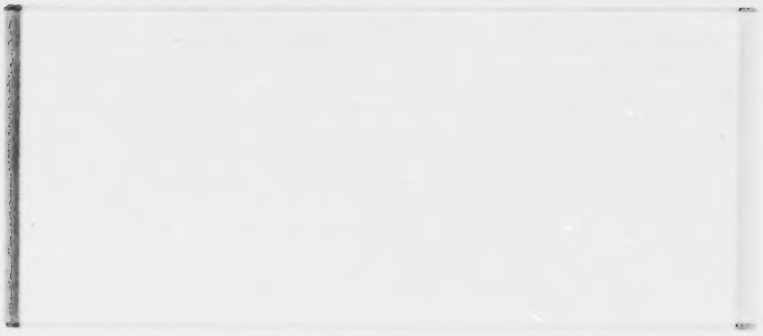
Un document préparé pour le

Conseil économique du Canada

C.P. 527
Ottawa (Ontario)
K1P 5V6



88-02330/



The **Economic Council of Canada** was established in 1963 by Act of Parliament. The Council is a crown corporation consisting of a Chairman, two Directors and not more than twenty-five Members appointed by the Governor in Council.

The Council is an independent advisory body with broad terms of reference to study, advise and report on a very wide range of matters relating to Canada's economic development. The Council is empowered to conduct studies and inquiries on its own initiative, or if directed to do so by the Minister, and to report on these activities. The Council is required to publish annually a review of medium- and long-term economic prospects and problems. In addition it may publish such other studies and reports as it sees fit.

The Chairman is the Chief Executive Officer of the Council and has supervision over and direction of the work and staff of the Council. The expenses of the Council are paid out of money appropriated by Parliament for the purpose.

The Council as a corporate body bears final responsibility for the *Annual Review*, and for certain other reports which are clearly designated as *Council Reports*. The Council also publishes *Research Studies*, *Discussion Papers* and *Conference Proceedings* which are clearly attributed to individual authors rather than the Council as a whole. While the Council establishes general policy regarding such studies, it is the Chairman of the Council who bears final responsibility for the decision to publish authored research studies, discussion papers and conference proceedings under the imprint of the Council. The Chairman, in reaching a judgment on the competence and relevance of each author-attributed study or paper, is advised by the two Directors. In addition, for *authored Research Studies* the Chairman and the two Directors weigh the views of expert outside readers who report in confidence on the quality of the work. Publication of an author-attributed study or paper signifies that it is deemed a competent treatment worthy of public consideration, but does not imply endorsement of conclusions or recommendations by either the Chairman or Council members.

Établi en 1963 par une Loi du Parlement, le **Conseil économique du Canada** est une corporation de la Couronne composée d'un président, de deux directeurs et d'au plus vingt-cinq autres membres, qui sont nommés par le gouverneur en conseil.

Le Conseil est un organisme consultatif indépendant dont le mandat lui enjoint de faire des études, donner des avis et dresser des rapports concernant une grande variété de questions rattachées au développement économique du Canada. Le Conseil est autorisé à entreprendre des études et des enquêtes, de sa propre initiative ou à la demande du Ministre, et à faire rapport de ses activités. Chaque année, il doit préparer et faire publier un exposé sur les perspectives et les problèmes économiques à long et à moyen termes. Il peut aussi faire publier les études et les rapports dont la publication lui semble opportune.

Le président est le directeur général du Conseil; il en surveille les travaux et en dirige le personnel. Les montants requis pour acquitter les dépenses du Conseil sont prélevés sur les crédits que le Parlement vote à cette fin.

En tant que personne morale, le Conseil assume l'entière responsabilité des *Exposés annuels*, ainsi que de certains autres rapports qui sont clairement désignés comme étant des *Rapports du Conseil*. Figurent également au nombre des publications du Conseil, les *Études*, *Documents* et *Comptes rendus de colloques*, qui sont explicitement *attribués à des auteurs particuliers* plutôt qu'au Conseil lui-même. Celui-ci établit une politique générale touchant ces textes, mais c'est au président qu'il incombe de prendre la décision finale de faire publier, sous les auspices du Conseil économique du Canada, les ouvrages à nom d'auteur tels que les études, documents et rapports de colloques. Pour se prononcer sur la qualité, l'exactitude et l'objectivité d'une étude ou d'un document attribué à son auteur, le président est conseillé par les deux directeurs. De plus, dans le cas des *études à nom d'auteur*, le président et les deux directeurs sollicitent l'avis de lecteurs extérieurs spécialisés, qui font un rapport confidentiel sur la qualité de ces ouvrages. Le fait de publier une étude ou un document à nom d'auteur ne signifie pas que le président ou les membres du Conseil souscrivent aux conclusions ou recommandations contenues dans l'ouvrage, mais plutôt que l'analyse est jugée d'une qualité suffisante pour être portée à l'attention du public.

DISCUSSION PAPER NO. 343

The Evolution of Poverty in Canada, 1970-1985

by

Pierre Perron and
François Vaillancourt

The findings of this Discussion Paper are the personal responsibility of the author(s) and, as such, have not been endorsed by the members of the Economic Council of Canada.

Discussion Papers are working documents made available by the Council, in limited number and in the language of preparation, to interested individuals for the benefit of their professional comments.

La série "Documents" contient des documents de travail dont le Conseil fait une diffusion restreinte, dans leur version d'origine, en vue de susciter des commentaires de la part de spécialistes.

Requests for permission to reproduce or excerpt this material should be addressed to:

Director of Publications
Economic Council of Canada
Post Office Box 527
Ottawa, Ontario
K1P 5V6

ISSN-0225-8013

February 1988

RÉSUMÉ

La présente étude a pour but d'examiner l'évolution de la pauvreté au Canada depuis 1970, et de présenter certaines explications des changements survenus. Le sujet est d'autant plus intéressant que la pauvreté au Canada a d'abord regressé de 1971 à 1981, puis s'est accrue entre 1982 et 1984, pour ensuite diminuer de nouveau à partir de 1985. Dans le premier chapitre, nous présentons les données utilisées, ce qui nous permet de traiter de la définition de la pauvreté ainsi que de son évolution de 1970 à 1985. Dans le second chapitre, nous avons recours à une méthode statistique de modélisation, proposée par Gottshalk et Danziger (1985) dans le contexte américain, pour examiner les relations entre les changements dans la répartition des revenus et de la pauvreté. Pour ce faire, nous distinguons la pauvreté dans une période donnée comme étant attribuable à des modifications de la moyenne du revenu gagné, de la moyenne des revenus de transfert et des inégalités. Dans le troisième chapitre, nous modélisons les facteurs déterminants de la pauvreté dans les cinq régions du Canada pour la période de 1971 à 1984.

ABSTRACT

The purpose of this study is to examine the evolution of poverty in Canada since 1970 and to present some explanations of these changes. This is of interest since in that period there was first a decline (1971-1981), then an increase (1982-1984) and finally a new decline from 1985 onwards in poverty in Canada. The study is divided in three chapters. In the first we present the data used, thus addressing the issue of what poverty is, and the evolution of poverty over the 1970-1985 period. In the second we use a statistical modeling technique suggested by Gottshalk and Danziger (1985) in the American context, to examine the relationship between changes in the distribution of income and poverty. In doing so, we separate the change in poverty in a given period as due to changes in mean market income, mean transfer income and inequality. In the third we model the determinants of poverty over the 1971-1984 period, across Canada's five regions.

CONTENTS

	Page
Foreword	vii
Acknowledgement	ix
1 The Measurement and Evolution of Poverty, Canada, 1970-1985	1
1.1 Measurement Issues and Data	2
2 The Relative Influence of Growth, Transfers and Inequality on Poverty	11
2.1 The Conceptual Framework	15
2.2 The Data and the Estimation Method	19
2.3 The Estimated Relative Effects of Growth, Transfers and Inequality on Poverty	26
3 The Determinants of Poverty in Canada, 1971-1985	35
3.1 The Literature on the Determinants of Poverty	36
3.2 The Model	38
3.3 The Results	41
4 Concluding Comments and Policy Implications	51
Bibliography	55
Appendices	57

FOREWORD

This paper represents part of the Council's social policy project. The purpose of this project is to study the links and trade-offs between economic activity and income-security programs in ways that permit an evaluation of the distributional impact of the programs and the economic costs of their potential reforms.

This paper, the third in a series, studies the changes that Canadian poverty rates have undergone since 1970. The major question addressed is about the extent to which the benefits of economic growth trickle down and result in reduced poverty rates. To this end the authors present new evidence of the effects of growth, transfer payments, and changes in income distribution on poverty rates.

The authors are professors of economics at the University of Montreal. Professor Vaillancourt was Research Director for the Royal Commission on the Economic Union and Development Prospects for Canada and currently is vice-president of the Centre de recherches en développement économique at the University of Montreal.

Judith Maxwell
Chairman

ACKNOWLEDGEMENT

This paper was prepared under contract for the Economic Council of Canada. The authors thank Martine Hébert, Josée Carpentier and Julie Grignon for their research assistance and Jac-André Boulet and participants in a seminar given at the Economic Council of Canada on October 2nd, 1987 for useful comments.

CHAPTER 1

THE MEASUREMENT AND EVOLUTION OF POVERTY
CANADA, 1970-1985

In the first part of this chapter, the measurement issues associated with the concept of poverty are discussed and the Canadian data presented. In the second part, the poverty rates for the period are examined.

1.1 Measurement issues and data

Who is poor, in a given society, is a value judgement, since poverty can be defined both in relative and absolute terms. In Canada, the two approaches are used. The needs, or budget approach which establishes the income needed to meet the needs (food, shelter, etc.) of a family of a given size is used by provincial welfare administrations, at least implicitly, and by other bodies such as the Social Planning Council of Metropolitan Toronto. The relative (divergence) method which defines poverty relative to the consumption or income of a reference group is used by two organisms. The Canadian Council on Social Development (CCSD) defines a family of three individuals as poor if its income is less than 50 percent of the average income of Canadian families of any size. The poverty lines for families of other sizes are calculated using a scaling formula (one-half for a family of one, five-sixths for a family of two, seven-sixths for a family of four, etc.). Statistics Canada defines as low income a family spending more than a given percentage of its income on food, shelter and clothing. That percentage, originally set at 70.0 percent in 1961, became 62.0 percent in 1973 (1969 low income cutoffs) and 58.5 percent (1978 low income cutoffs) in 1981.[1]

Table 1-1 shows that the poverty lines used in each case are not the same and they yield different results. For example, 24.7 percent of

---

[1] The calculation leading to these low income cutoffs uses the percentage of income spent by the average Canadian family on necessities (42.5 percent in 1969, according to the FAMEX survey for that year) and then adds an arbitrary 20 percent. Low income cutoffs are calculated for various family sizes and areas of residence of various size. Low income cutoffs are commonly referred to as poverty lines.

families and 41.2 percent of unattached individuals were below the poverty line in 1979 according to CCSD data. By contrast, 13.1 percent of families and 40.3 percent of unattached individuals were below Statistics Canada's low income cutoff (1978 base) in the same year.[2]

TABLE 1.1: Low Income Lines in Canada, 1983

Family Size	Social Assistance[a]	Statistics Canada[b]	CCSD
	$	$	$
One member	3 956	9 538	8 625
Four members	9 860	19 397	20 125

Source: Canadian Council on Social Development, Task Force on the Definition and Measurement of Poverty in Canada, Not Enough: The Meaning and Measurement of Poverty in Canada (Ottawa: CCSD, 1984), p. 25.

a. Includes family allowances and child benefits.
b. Urban families, 1978 base.

In this study we use the definition of poverty used most commonly in the policy discussion of these issues, that is the percentage of families and individuals with incomes below the low income cutoffs of Statistics Canada.

In the period under study, two sets of poverty rates are available: the first is calculated from 1971 onwards, using the 1969 low income cutoffs. The second is calculated from 1979 onwards using 1978 low income cutoffs. As shown in Table 1.2, these poverty rates differ.

Table 1.2
Poverty Rates of Persons, Canada, 1981, 1983, 1985; 1969 and 1978 Low Income Cutoffs

Low income cutoffs	Poverty Rates for 1981	1983	1985
1969 (1)	11.0	12.8	11.8
1978 (2)	14.7	17.1	16.0
Ratio of 1978 to 1969 rate			
(2) ÷ (1)	1.34	1.34	1.36

Source: Income Distribution by Size in Canada, 1985, Statistics Canada (13-207), Table 85.

2 CCSD results are from Ross (1984), Table 2, Statistics Canada data are from Income Distributions by Size in Canada, 1981, Table 85.

The 1978-based rate is always higher. This is the expected result since 1978 cutoffs are based on a lower percentage of income going to necessities. Everything else equal, changing the definition of who is poor from those spending more than say 60 % of their income on necessities to those spending more than say 55 % of their income on these goods will automatically increase the poverty rate. Of course changes in real income and in the distribution of income may counteract this in part or in total.

Given the availability of 1969-based results over a longer period of time (1971-1985) than 1978-based results (1979-1985) and given the quasi-constancy of the ratio of the 1969-based and 1978-based poverty rates (Table 1.2), we will use the 1969-based poverty rates and cutoffs.

The data on poverty rates have been computed on a yearly basis since 1971, using data collected through the Survey of Consumer Finances of Statistics Canada. From 1971 to 1983, two types of surveys were used:

- the large sample survey was used for 1971, 1973, 1975, 1977, 1979 and 1982. It is conducted as a supplement to the April Labour Force Survey. In 1981, the sample size for Canada as a whole was 37,904.

- the small sample survey was used in 1972, 1974, 1976, 1978, 1980 and 1983. It is conducted independently of the Labour Force Survey. In 1980 the sample size for Canada as a whole was 15,340.

Since 1984, only large sample surveys are conducted on a yearly basis.

The evolution of poverty in Canada: 1971-1985

As pointed out in the introduction and as will be shown in Table 1.3, the percentage of persons living in poverty decreased in Canada from 1971 to 1981, increased from 1982 to 1984 and finally decreased anew in

TABLE 1.3

Poverty Rates in Canada, 1971-1985;
1969 Low-Income Cutoffs

Year	Families (1)	Individuals (2)	All Units (3)	Persons (4)
1971	18.3	43.1	24.6	20.6
1972	15.8	39.8	22.1	-
1973	13.4	40.2	20.6	15.8
1974	11.3	37.5	18.5	-
1975	11.8	38.2	19.2	14.2
1976	11.2	34.3	17.7	-
1977	11.2	36.8	18.4	13.3
1978	10.3	34.9	17.5	-
1979	10.4	32.3	16.8	12.4
1980	9.7	29.1	15.6	11.8
1981	9.3	26.8	14.3	11.0
1982	10.1	27.1	15.0	12.0
1983	10.9	28.9	16.0	12.8
1984	11.2	27.3	15.8	12.9
1985	10.2	24.4	14.3	11.8

Note : (1): Economic families; (2): unattached individuals; (3): (1) + (2), weighted by their respective number; (4): all persons including children in economic families and unattached individuals.

- Unavailable data.

- Economic families are defined as a group of individuals sharing a common dwelling unit and related by blood, marriage or adoption. This definition encompasses more individuals than the census family definition which corresponds more closely to the usual nuclear family (plus grandparents) definition.

Sources: Income Distributions by Size in Canada, Statistics Canada (13-207):

- Data for 1971, 1973, 1975, 1977, 1979, 1980, 1981, 1982, 1983 and 1984 are taken from Table 85 (13-207, 1984), data for 1985 from Table 85 (13-207, 1985).

- Data for 1972 have been calculated with estimations based on low income cut-offs established in 1961 and 1969: (see 13-207, 1971 and 1972, Table 64).

$$\text{Families poverty rate of 1972 (1969-base)} = \frac{13.7\ (1972,\ 1961\text{-base}) \times 18.3\ (1971,\ 1969\text{-base})}{15.9\ (1971,\ 1961\text{-base})}$$

- Data for 1974, 1976 and 1978 are respectively taken from Tables 64, 62 and 64 (13-207, 1974, 1976 and 1978).

1985. Similar changes are observed in the case of families and individuals.

Two questions arise when examining the results of Table 1.3. First, are all Canadians equally susceptible to poverty or are some Canadians (the aged, the lone-parent families, ...) more likely than others to incur poverty? Second, can the changes in the poverty rate be explained by changes in economic variables (output, unemployment rate, ...), in transfers to individuals or by changes in the structure of the population? We will now address the first question using descriptive statistics. The second question will be examined in Chapter 3.

Statistics Canada presents data on the incidence of poverty for twenty-one characteristics of the household, such as age, tenure, education, occupation, etc. After examining this evidence and taking into account both the impact of a characteristic (as shown by the spread in poverty rates between the various categories of that characteristic) and the explanatory nature of a characteristic (for example, the type of tenure is more likely to be a result than an explanation of poverty), poverty rates are presented for what we feel to be four important characteristics: weeks worked, number of earners, age and family characteristics.

The relationship between poverty and the first two characteristics, both of which are indicators of labour market activity is presented in Table 1.4 for five years. What comes through is the importance of employment in preventing poverty: the greater the number of weeks worked, by the head or individual, or the greater the number of earners, the lower the incidence of poverty. This relationship holds throughout the period.[3]

Turning to Table 1.5, one notes a changing relationship between age and poverty and a stable one with respect to family characteristics.

---

[3] We do not have 1969-based poverty rates for these variables for 1971. Hence tables 1-4 and 1-5 start in 1973.

TABLE 1.4

Incidence of Poverty by Weeks Worked and by Number of Earners, Families and Individuals, Canada, 1973, 1977, 1981, 1983 and 1985; 1969 Low-Income Cutoffs

Characteristics	Families					Individuals				
	Year					Year				
Weeks Worked	1973	1977	1981	1983	1985	1973	1977	1981	1983	1985
None	40.1	36.2	25.6	27.1	23.5	72.1	69.3	47.9	47.2	37.7
1-9	48.3	38.5	47.3	36.5	42.3	76.7	60.6	67.8	62.9	68.0
10-19	37.7	27.1	28.4	33.4	27.9	70.7	60.7	54.5	60.1	53.8
20-29	25.7	17.2	17.1	16.6	17.7	44.5	39.3	41.3	32.7	38.6
30-39	16.5	12.7	10.1	14.1	12.9	29.0	25.4	24.4	28.2	27.4
40-48[1]	12.3	11.0	8.9	7.8	11.5	10.8	18.4	15.8	10.5	17.6
49-52	6.0	4.0	3.4	3.6	3.6	13.2	7.9	6.6	6.9	7.0
Number of Earners										
None	53.9	50.2	33.8	33.4	29.3	74.8	71.0	49.1	47.3	36.6
One	16.0	13.4	13.7	15.3	15.6	20.4	17.6	14.4	17.4	17.0
Two	4.9	3.3	3.2	4.9	4.0	0.0	0.0	0.0	0.0	0.0
Three or more	2.6	1.8	1.7	2.3	2.2	0.0	0.0	0.0	0.0	0.0

Source: Income Distributions by Size in Canada, Statistics Canada (13-207); 1973: Table 78; 1977: Table 83; 1981: Table 86; 1983: Table 65; 1985: Table 86.

[1] The numbers of weeks worked given in 1973 and 1977 catalogues were 40-49 and 50-52 (instead of 40-48 and 49-52).

TABLE 1.5

Incidence of Poverty by Age and by Family Characteristics, Families and Individuals, Canada, 1973, 1977, 1981, 1983 and 1985; 1969 Low-Income Cutoffs

Characteristics	Families Year 1973	1977	1981	1983	1985	Individuals Year 1973	1977	1981	1983	1985
Age[1]										
24 and under	16.0	15.6	19.3	29.5	27.3	40.6	35.2	30.6	40.9	38.7
25-34	11.7	10.8	10.2	13.4	13.0	16.5	14.5	13.3	17.9	16.3
35-44	12.6	9.3	8.2	10.4	10.1	18.7	20.2	16.6	21.4	17.0
45-54	9.6	7.5	7.0	8.2	6.8	31.4	30.3	24.4	29.1	27.1
55-64	12.3	10.0	8.2	9.1	9.3	42.4	40.9	33.6	32.1	36.5
65-69[2]	21.4	18.4	10.9	6.7	6.5	51.7	51.4	29.1	32.1	23.0
70+[2]	26.2	23.0	8.6	-	4.9	66.6	60.6	38.4	-	18.3
Family characteristics										
-Married couples only	13.5	11.3	6.3	6.7	5.7	-	-	-	-	-
-Married couples with single children	9.9	7.0	6.5	8.0	7.1	-	-	-	-	-
-(All) other[3] families	35.1	32.1	-	-	-	-	-	-	-	-
Male lone parent	-	-	10.2	14.4	15.4	-	-	-	-	-
Female lone parent	-	-	38.1	44.3	42.7	-	-	-	-	-
Other families	-	-	12.8	15.4	13.4	-	-	-	-	-

Source: Income Distributions by Size in Canada, Statistics Canada (13 207).
Data for 1973 are taken from Table 78 (13 207, 1973).
Data for 1977 are taken from Table 83 (13 207, 1977).
Data for 1981 are taken from Table 86 (13 207, 1981).
Data for 1983 are taken from Table 65 (13 207, 1983).
Data for 1985 are taken from Table 86 (13 207, 1985).

Notes: [1] Age of the head.

[2] The 65-69 and 70+ categories are not available for 1983 so data are for 65 and over category.

[3] This category only available for 1973 and 1977 includes the following three categories for 1981, 1983 and 1985.

From 1973 to 1985, poverty amongst the elderly declines while it increases amongst the young (24 and less). This probably reflects both the deterioration of the labour market and the increased real transfers to elderlies (maturing C/QPP, GIS). As for family characteristics, female lone-parent families, often the result of divorce, are much more likely to be poor than other families.

CHAPTER 2

THE RELATIVE INFLUENCE OF GROWTH, TRANSFERS AND INEQUALITY ON POVERTY

The growth of the economy permits the implementation of income-security programs by increasing the real resources devoted to these transfers without reducing the real disposable income of the contributors. However, growth may also have direct effects by increasing the earned income of individuals and lifting them out of poverty. Indeed, it is a common belief that growth acts as "a rising tide which lifts all boats". At the beginning of his mandate, President Reagan argued that poverty would be much better handled by economic growth, in general, than by welfare programs. The argument was used to justify major cuts in these programs. As Danzinger (1983, p. 69) argues: "The Reagan program assumes that those who remain poor will be better off waiting for economic growth to trickle down from those above them rather than relying on welfare and public job programs."

Does growth per se have such a beneficial effect on poverty? Can we expect such a trickle-down effect to occur in the present economic context? Most empirical analyses conclude that growth played an important role in alleviating poverty in the immediate post-war period, but that this effect has dissipated subsequently. Let us look at some of the reasons why growth may not now have the same impact in reducing poverty than it had before (see Danziger and Gottschalk (1986).

First, there are changing demographic factors. For example, in the United States in 1979, two-thirds of all poor households were headed by individuals generally not expected to work (elderly, students, disabled, or women with children under the age of 6). In 1939, the proportion was less than one third. It is clear that growth alone cannot eliminate poverty for households whose heads have such a tenuous attachment to the labor force. They could benefit indirectly if the increased tax revenue obtained was redistributed through antipoverty programs.

Secondly, growth not only changes the mean of the income distribution but also its shape. Changes in the variance and other moments of the distribution will also have an impact on poverty. There is no a priori reason to believe that an increase in mean income automatically reduces the number of households under some poverty level. Indeed, it seems to be the case that growth increases the inequality of the income distribution as well as its mean.

If it is the case that an increase in the mean of the income distribution is accompanied by increased inequality, it may be the case that the negative effect of increased inequality on poverty outweights the beneficial impact of rising average income. For example, a 5 % increase in average income may imply, ceteris paribus, a 3 % decline in the official poverty rate. However, if this 5 % increase is accompanied by an increase in inequality such that an additional 3 % of the population falls to the left of the official low-income cutoffs, the beneficial impact of growth in mean income would vanish due to this increased inequality.

Thirdly, even abstracting from changes in inequality, there is a non-linear relationship between growth (through an increase in the mean) and poverty. "[...] as long as the poverty line falls to the left of the mode of the income distribution, fewer and fewer people will be taken out of poverty as the distribution shifts to the right" (Danziger and Gottschalk (1986), p. 406). In a sense, there are diminishing returns for the poor of economic growth. For example, suppose that in a given ten year period a doubling of the real average income occured with a non concurrent change in inequality. Suppose that this increase caused the poverty level to decrease from 20 % to 10 % of the total population, it is clear that a further doubling of the average income will not succeed in diminishing the poverty rate by another 10 % points (which would imply a zero poverty rate). This is due to the fact that more households are clustered around the mean of the distribution than in the tails and bringing those households with very low income above a given poverty threshold requires a greater proportional increase in income.

A further distinction must be drawn between secular growth and cyclical recovery to understand the impact of macroeconomic conditions on poverty. Secular growth reflects increases in potential output due to increases in productivity and factor supply. It accounts for the long term trend in the growth of output which operates primarily through higher wage rates. Increased investment and technological changes will increase the growth potential of the economy. However, over a short period of time, this increased potential is realized more easily by increasing the number of hours an unemployed person works than by increasing the productivity of a fully employed person. Therefore, cyclical recovery operates mainly via an increase in the quantity of labor employed. Accordingly, improvements in cyclical conditions will have a much greater impact on poverty than secular growth. First, the yearly secular growth in mean-income is small compared to cyclical increases. Secondly, growth may be accompanied by increased inequality.

Recently, Gottschalk and Danziger (1985) developed a framework for measuring the relative effect of growth, transfers and changes in inequality on the level of poverty. The method is based on a cross section of data on market and transfer incomes. The aim is to analyse the relationship between changes in the location and shape of the joint distribution of these two income sources and the level of poverty as a summary measure of inequality.

This chapter presents the conceptual framework developed by Gottschalk and Danziger (section 2.1). Section 2.2 discusses how the various effects can be empirically estimated and briefly discusses the data used. Section 2.3 reports the empirical results obtained in the Canadian context and discusses the policy implications that follow. We also compare our results to those obtained by Gottschalk and Danziger (1985) and Danziger and Gottschalk (1986) in the American context.

2.1 THE CONCEPTUAL FRAMEWORK[9]

The conceptual framework is based on analysing the joint distribution function of market and transfer income and to relate changes in the poverty rate in terms of changes in this underlying distribution. First, let us define the following variables:[10]

I_1: market income

I_2: transfer income

P: the poverty rate

T: the poverty threshold

$g(I_1, I_2, m)$: the joint density function of market and transfer income defined in terms of a vector of parameters m (of dimension k x 1).

We can then define the poverty rate as:

$$(2.1) \quad P = \int_{-}^{T} \int_{-}^{T-I_2} g(I_1, I_2, m)\, dI_1 dI_2 .$$

Equation (2.1) simply states that the poverty rate is equal to the probability that the sum of market and transfer income be less than the poverty threshold T. Given a functional form for the function $g(\cdot)$, the vector of parameters m can be estimated given: 1) a poverty rate, 2) a poverty threshold, 3) a sample of data on market income and 4) a sample of data on transfer income. This vector of estimated parameters along with the functional form postulated allow us to obtain an empirical joint

---

9 The description of this section closely follows the presentation in Section 1 of Gottschalk and Danziger (1985). The reader should refer to that article for more details.

10 The empirical counterpart to these definitions is given in Section 2.2.

distribution of market and transfer income. Note here the important aspect of this method which only requires a cross section of data, unlike the usual framework based on a time series of data (see Chapter 3 of the present study).

Given an estimated functional form, i.e., an estimated vector of parameters m of the joint distribution, we can write the total differential of P with respect to its k parameters as:

$$(2.2) \quad dP = \sum_{i=1}^{k} (\partial P/\partial m_i)dm_i .$$

Changes in the parameters m_i will reflect (as will become clearer below) changes in the moments of the distribution. These in turn can be interpreted as the effect of changes in the growth of market income, transfer income and inequality, thereby separating the relative effects of these three components.

The specification of the poverty rate in (2.1) presents a problem for practical application because the poverty threshold T is not fixed across the sample of data as it changes by family size. To avoid excessive complexity, it is preferable to work in terms of the income to needs ratio defined as:

$$(2.3) \quad I^* = (I_1 + I_2)/T .$$

With this specification, any household with an income to needs ratio I* less than one is poor and the poverty rate is defined as:

$$(2.4) \quad P = \int_{-\infty}^{1} g(I^*, m)dI^*$$

where g(I*, m) now is the density function of the income to needs ratio I*, again indexed by a vector of parameters m.

The central assumption underlying this analysis is the specification of a functional form for the distribution function of the income to needs ratio. The choice proposed by Gottschalk and Danziger was to use the displaced log normal distribution function.[11] Two principles led them to these choices: 1) the functional form should depend on a few number of parameters to make empirical work tractable and 2) should be less restrictive than the functional form used elsewhere in the income distribution literature. The displaced log normal is a three-parameter distribution, which is more general than the commonly used log normal distribution, because it allows the presence of negative skewness.

The parameters of the displaced log normal distribution are defined as μ, σ, and c. The parameter c is defined as the displacement factor and changes in c represent partial effects of changes in the third moment about the mean. The other parameters are the first two moments of the distribution of $\ln(I^* + c)$ defined as

$$(2.5) \quad \mu = E[\ln(I^* + c)]$$

$$(2.6) \quad \sigma^2 = Var[\ln(I^* + c)] \ .$$

With these specifications, we define the following variable Z:

$$(2.7) \quad Z = [\ln(I^* + c) - \mu]/\sigma$$

which has a standardized normal distribution with density $\phi(Z)$. Given that poverty is defined as an income to needs ratio less than one, we can express it in terms of the distribution of $\ln(I^* + c)$ as:

---

11 Gottschalk and Danziger (1985) present some evidence that the assumption of a displaced log normal distribution function for the income to needs ratio is appropriate with the U.S. sample of data used. However, some problems occur when considering some subgroups of the population in their analysis. The same problem arises in the Canadian context and is discussed in Section 2.3.

$$(2.8) \quad P = \int_{-\infty}^{h} \phi(Z)dZ$$

where $h = [\ln(1.0 + c) - \mu]/\sigma$.

It will be useful, when interpreting the results, to have the first two moments of $\ln(I^* + c)$, μ and σ^2, defined in terms of the first two moments of I^* i.e., the mean α and the variance β^2. To this effect, we can use the following relationships:

$$(2.9) \quad \mu = \ln \left\{ \frac{(\alpha + c)^2}{[\beta^2 + (\alpha + c)^2]^{\frac{1}{2}}} \right\}$$

$$(2.10) \quad \sigma^2 = \ln \left\{ \frac{[\beta^2 + (\alpha + c)^2]}{(\alpha + c)^2} \right\}$$

In accordance with equation (2.2), we can decompose changes in poverty into three components:

$$(2.11) \quad dP = (\partial P/\partial \alpha)d\alpha + (\partial P/\partial \beta^2)d\beta^2 + (\partial P/\partial c)dc .$$

Since α is the mean of I^* and β^2, its variance, we have:

$$(2.12) \quad \alpha = E(I^*) = E(I_1^*) + E(I_2^*)$$

$$(2.13) \quad \beta^2 = Var(I^*) = Var(I_1^*) + Var(I_2^*) + 2COV(I_1^*, I_2^*) .$$

Therefore equation (2.11) can be expressed as:

$$\begin{aligned} (2.14) \quad dP = {} & (\partial P/\partial \alpha)dE(I_1^*) + (\partial P/\partial \alpha)dE(I_2^*) \\ & + (\partial P/\partial \beta^2)dVar(I_1^*) + 2(\partial P/\partial \beta^2)dCOV(I_1^*, I_2^*) \\ & + (\partial P/\partial \beta^2)dVar(I_2^*) + (\partial P/\partial c)dc . \end{aligned}$$

This expression shows how total changes in poverty can be decomposed into changes in poverty due to changes in the mean and the dispersion of each income source, their covariance and the displacement factor, c.

All that remains to be given are the expressions for the partial derivatives in (2.14). These were derived by Gottschalk and Danziger and are given by:

$$(2.15) \quad \frac{\partial P}{\partial \alpha} = \frac{\phi(h)}{\sigma^2(\alpha + c)\left[\beta^2 + (\alpha + c)^2\right]} \times \left\{h\beta^2 - \sigma\left[2\beta^2 + (\alpha + c)^2\right]\right\}$$

$$(2.16) \quad \frac{\partial P}{\partial \beta^2} = \frac{\phi(h)}{2\sigma^2\left[\beta^2 + (\alpha + c)^2\right]}\left[\sigma - h\right]$$

$$(2.17) \quad \frac{\partial P}{\partial c} = \frac{\phi(h)}{(1 + c)\sigma} + \frac{\partial P}{\partial \alpha}$$

2.2 The data and the estimation method

To calculate the partial derivatives described by equations (2.15) to (2.17) we need an estimate of α, β^2, and c for each year that data are available. The present study considers four years where we have a cross section of data containing information on market income and transfer income for a large number of households. These years are: 1977, 1981, 1982 and 1984. Except for 1982, the data source is the Survey of Consumer Finances microdata file (economic families). For 1982, the data is taken from the Survey of Family Expenditures microdata file (unattached individuals and economic families only). From these sources of data, we construct the variable market income as the sum of wages and salaries, self employment income, investment income and other income. Transfer income is defined as both taxable and non-taxable transfers. The poverty threshold for each family size and region of residence is given by the low income cutoffs of Statistics Canada (Appendix A describes, in more detail, the sources of the data and the variables used).

TABLE 2.1A: Moments, Displacement Factors, Partial Derivatives and Poverty Rates, Canada

All Households

Year	Mean		Variance		Covariance of market income and transfer	Displacement factor c	Partial Derivative with respect to			Official Poverty Rate
	Market Income ÷ Needs	Transfer Income ÷ Needs	Market Income ÷ Needs	Transfer Income ÷ Needs			Means	Variances	Displacement	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1977	2.252	0.247	3.102	0.107	-0.253	6.3658	-0.2402 (-0.2260)	0.0581 (0.0545)	0.0229 (0.0239)	0.180
1981	2.386	0.269	3.438	0.130	-0.305	1.1569	-0.2123 (-0.2080)	0.0510 (0.0523)	0.0247 (0.0244)	0.134
1982	2.333	0.328	3.270	0.150	-0.361	0.6930	-0.2032 (-0.2199)	0.0536 (0.0554)	0.0241 (0.0239)	0.107
1984	2.184	0.340	3.286	0.177	-0.349	1.1706	-0.2360	0.0567	0.0232	0.153

TABLE 2.1B: Moments, Displacement Factors, Partial Derivatives and Poverty Rates, Canada

Young Men

Year	Mean		Variance		Covariance of market income and transfer	Displacement factor c	Partial Derivative with respect to			Official Poverty Rate
	Market Income ÷ Needs	Transfer Income ÷ Needs	Market Income ÷ Needs	Transfer Income ÷ Needs			Means	Variances	Displacement	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1977	2.231	0.132	2.394	0.062	-0.094	-	-	-	-	0.194
1981	2.368	0.125	2.421	0.056	-0.111	7.9548	-0.2282 (-0.2119)	0.0657 (0.0668)	0.0223 (0.0220)	0.157
1982	2.383	0.178	2.154	0.069	-0.148	1.899	-0.1932	0.0672	0.0213	0.103
1984	1.859	0.196	1.957	0.098	-0.115	-	-	-	-	0.235

TABLE 2.1C: Moments, Displacement Factors, Partial Derivatives and Poverty Rates, Canada

Prime-Aged Men

Year	Mean		Variance		Covariance of market income and transfer	Displacement factor c	Partial Derivative with respect to			Official Poverty Rate
	Market Income ÷ Needs	Transfer Income ÷ Needs	Market Income ÷ Needs	Transfer Income ÷ Needs			Means	Variances	Displacement	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1977	2.751	0.149	2.817	0.054	-0.134	1.5856	-0.1452 (-0.1389)	0.0444 (0.0408)	0.0223 (0.0226)	0.080
1981	2.904	0.141	3.242	0.050	-0.143	1.2083	-0.1326 (-0.1310)	0.0375 (0.0390)	0.0228 (0.0220)	0.070
1982	2.787	0.194	2.937	0.077	-0.197	0.630	-0.1288 (-0.1440)	0.0406 (0.0424)	0.0212 (0.0227)	0.050
1984	2.694	0.199	3.219	0.087	-0.210	1.9175	-0.1587	0.0438	0.0240	0.099

TABLE 2.1D: Moments, Displacement Factors, Partial Derivatives and Poverty Rates, Canada

Elderly Persons

Year	Mean		Variance		Covariance of market income and transfer	Displacement factor c	Partial Derivative with respect to			Official Poverty Rate
	Market Income ÷ Needs	Transfer Income ÷ Needs	Market Income ÷ Needs	Transfer Income ÷ Needs			Means	Variances	Displacement	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1977	0.967	0.706	2.225	0.090	-0.091	1.5765	-0.3811 (-0.3649)	0.0645 (0.0670)	-0.00938 (-0.00133)	0.372
1981	1.127	0.831	2.535	0.096	-0.142	-0.5704	-0.3441 (-0.3521)	0.0677 (0.0697)	0.00589 (0.00426)	0.193
1982	1.024	0.852	2.327	0.110	-0.138	-0.6039	-0.3604 (-0.3509)	0.0718 (0.0740)	0.00259 (0.00619)	0.210
1984	1.069	0.940	2.314	0.126	-0.150	-0.6223	-0.3396	0.0756	0.00949	0.142

For each household, we divide the market income and the transfer income by the appropriate poverty threshold thereby obtaining a measure of market income to needs ratio and transfer income to needs ratio. The average of these ratios over all households are presented in Columns (1) and (2) of Table 2.1 for each category considered. These categories are: A) all households, B) young men (households headed by a male less than 25 years of age), C) prime-aged men (households headed by a male between the ages of 25 and 64) and D) elderly (households headed by a person 65 years of age or older).[12] From equation (2.12) the parameter α can be estimated by the sum of the values in columns (1) and (2). The data reveals that for each category, the transfer income to needs ratio has risen from 1977 to 1984. For "all households" and "young men", the market income to needs ratio has risen from 1977 to 1982 but has declined between 1982 and 1984. For "prime-aged men", the decline started in 1981 while for the elderly it increased from 1977 to 1981, then decreased between 1981 and 1982 before increasing slightly in 1984.

Columns (3) and (4) of Table 2.1 present the computed values for the variance of the market income to needs ratio and the transfer income to needs ratio respectively. The covariance of market income and transfer income is given in column (5). The values in these columns can be used to obtain an estimate of β^2 according to equation (2.13).

---

12 We also analysed two other subgroups: a) households headed by a female between the ages of 25 and 64 and b) households headed by a female less than 25 years of age. The method described in the previous section did not work with those subgroups. This occurred because we were unable to estimate the displacement parameter c. Indeed the method which is used requires the existence of a value of c consistent with the observed poverty rate and the mean and variance of the group-specific income-to-needs distribution. No such values existed for the two sub-groups described here. Note that Gottschalk and Danziger (1985) encountered a similar problem with the following groups: a) households headed by a non-aged female and b) households headed by a black male or female. This failure in estimating the displacement parameter in those instances suggests that the displaced log normal distribution is not a satisfactory approximation for the distribution of the income to needs ratio in these subgroups. Further research using alternative distributional assumptions would be desirable.

The estimation of the displacement factor c requires more complex procedures. First, note that from equation (2.8) one can obtain an estimate of h given an estimate of the poverty rate.[13] The poverty rate itself is computed, for each year and category, as the percentage of households in the sample with a total income to needs ratio less than one. This value is presented in column (10). For each category, except that of the "elderly", we can see that the poverty rate declined from 1977 to 1982 but increased from 1982 to 1984.

Given these estimates of P and h (as well as α and β^2) one can obtain an estimate of the displacement factor c. Using equations (2.8) through (2.10) we have:

$$(2.18)\quad h = \left[\ln(1.0 + c) - \ln\left\{\frac{(\alpha + c)^2}{\left[\beta^2 + (\alpha + c)^2\right]^{\frac{1}{2}}}\right\}\right]\left[\ln\left\{\frac{\left[\beta^2 + (\alpha + c)^2\right]}{(\alpha + c)^2}\right\}\right]^{-\frac{1}{2}}.$$

Expression (2.18) represents a single non-linear equation in one unknown, c. Though non-linear, this equation can be solved numerically to obtain an estimate of c.[14] Column (6) of Table 2.1 gives the estimated values for each year and category. Note, however, that we were unable to obtain an estimate for the years 1977 and 1984 for the category "young men".[15]

Finally, these estimates of α, β^2 and c permit us, via equations (2.15) through (2.17), to compute the partial derivatives necessary to obtain the relative effect of changes in the means and dispersions of each income source as well as their covariance and the displacement factor on the changes in total poverty. The calculated values are

---

13 From (2.8), the value h is the value such that a normal random variable with mean zero and variance one has a probability P (the poverty rate) of being less than h.

14 Equation (2.18) was solved numerically using the subroutine ZSCNT of the International Mathematical and Statistical Library (IMSL).

15 See footnote 12 for an explanation. In terms of equation (2.18), the reason for the failure is the non-existence of a value of c such that equation (2.18) is satisfied given the parameters α, β^2 and h, available for some years and categories.

presented in columns (7) through (9). In these columns two sets of values are presented; one set with a value for each of the years available and a set in parentheses for each adjacent pair of years. The first set uses the actual values of α, β^2 and c for each year in calculating the partial derivatives. However, since we shall approximate the total derivatives in (2.14)[16] as the change between two adjacent years it seems appropriate that we approximate the partial derivatives $(\partial P/\partial \alpha)$, $(\partial P/\partial \beta^2)$ and $(\partial P/\partial c)$ as the derivatives evaluated using averages of α, β^2 and c over the two adjacent years. For these reasons, the values in parentheses in columns (7) through (9) are the partial derivatives calculated using the averages of α, β^2 and c over two adjacent years.

2.3 The estimated relative effects of growth, transfers and inequality on poverty

Table 2.2 presents the estimated decomposition of the changes in poverty for the various groups studied. It decomposes the actual percentage point change in poverty between two adjacent years of data available into six relative effects. These relative effects are associated with a change in one of the following parameters: $E(I_1^*)$, the mean market income; $E(I_2^*)$, the mean transfer income; $Var(I_1^*)$, the variance of market income; $Var(I_2^*)$, the variance of transfer income, $COV(I_1^*, I_2^*)$, the covariance of market and transfer incomes and c, the displacement factor.

Each value is calculated from data in Table 2.1 as follows. We calculate the change in one of the variables between two adjacent sample years and multiply it by the corresponding elasticity. For example, let us consider the effect of a change in mean market income on the poverty rate for the category "all households" between the years 1977 and 1981.

---

16 These total derivatives are: dP, $dE(I1^*)$, $dE(I2^*)$, $dVar(I1^*)$, $dVar(I2^*)$, $dCOV(I1^*, I2^*)$ and dc. These are approximated as the difference in the values between two adjacent years.

TABLE 2.2: Decomposition of Changes in Poverty, Canada

Estimated Point Change in Poverty Associated with a Change in

	Actual percentage point change in poverty (1)	$E(I_1^*)$ (2)	$E(I_2^*)$ (3)	$Var(I_1^*)$ (4)	$Var(I_2^*)$ (5)	$COV(I_1^* I_2^*)$ (6)	c (7)
All households							
1977-81	-4.6	-3.03	-0.497	1.831	0.125	-0.5668	-12.499
1981-82	-2.7	1.102	-1.227	-0.8786	0.1046	-0.5858	-1.132
1982-84	4.6	3.277	-0.264	0.0886	0.1496	0.133	1.14
Young men							
1981-82	-5.4	-0.31785	-1.123	-1.783	0.0868	-0.49432	-13.32
Prime-aged men							
1977-81	-1.0	-2.125	0.1111	1.734	-0.0163	-0.0734	-0.8527
1981-82	-2.0	1.5327	-0.6943	-1.1895	0.1053	-0.4212	-1.2723
1982-84	4.9	1.3392	-0.072	1.1957	0.0424	-0.11024	2.9226
Elderly							
1977-81	-23.3	-5.8384	-4.561	2.077	0.0402	-0.6834	0.2855
1981-82	1.7	3.6266	-0.7394	-1.44976	0.09758	0.05576	-0.014
1982-84	-6.8	-1.57905	-3.088	-0.0962	0.1184	-0.1776	-0.0114

The mean market income for this category was 2.252 in 1977 and 2.386 in 1981. The difference between these two values multiplied by the partial derivative of the poverty rate with respect to means ($\partial P/\partial \alpha$) evaluated using the average values of the parameters of the distribution over the two sample years, i.e., -0.2260, gives a value of -3.03. Therefore we estimate that of the 4.6 percentage point decline in poverty for the group "all households" between the years 1977-1981, 3.03 were due to an increase in the mean market income over needs ratio. Each value in Table 2.2 is calculated in a similar fashion according to equation (2.14) using the partial derivative evaluated using the average values of α, β^2 and c over the two adjacent years.

A word of caution is necessary before presenting the results obtained. According to equation (2.14), the change in poverty should equal the sum of the six effects mentionned above. This is not necessarily the case here, and the divergence is especially severe for the following cases: "all households" 1977-81, "young men" 1981-82 and "Elderly" 1977-81. The reason is that equation (2.14) states the decomposition in terms of derivatives which in practice we approximate by differences in values over two adjacent years. One can expect equation (2.14) to be appropriate insofar as the differences are relatively small, i.e., insofar as the variables do not change dramatically over two adjacent sample years. For the categories "all households" 1977-81 and "young men" 1981-82, the displacement parameter changed drastically (see Table 2.1), we can therefore expect the values -12.499 and -13.32 in Table 2.2 to be inaccurate in that they overstate the true effect of the displacement factor on the poverty rate of these groups. For the elderly in 1977-81, the change in poverty was indeed quite large, -23.3 and for that year the sum of the estimated relative effects is well below that figure.

A potential way to alleviate this problem would be to use data every year so as to minimize the risk of having large changes and therefore expect equation (2.14) to be a better approximation. This was

done in the American context by Gottschalk and Danziger (1985) and explains why, for the group they analysed (all households) equation (2.14) held quite satisfactorily. Unfortunately, no samples of data are available on a yearly basis before 1984 for Canada. The values obtained for the three group-years mentionned above should be viewed with caution. The other estimated values appear quite satisfactory.

To obtain a better grasp of the results, we present, in Table 2.3, the contributions to total changes in poverty according to three effects associated with a change in: 1) the mean market income over needs ratio, 2) the mean transfer income over needs ratio and 3) the shape of the distribution. The first two elements are taken as columns (2) and (3) of Table 2.2 respectively and the effect of the shape of the distribution is taken as the residual between these two effects and the actual change in the poverty rate.[17] This classification permits us to decompose a given change in poverty according to the three effects mentionned in the introduction, namely the effects of changes in growth (column (1)), transfers (column (2)) and inequality (column (3)).

Let us analyse the results contained in Table 2.3 in more details. The period 1977-81 saw a decline in poverty for all groups. The effect of changes in market income was beneficial for all groups and the effect of changes in transfers and inequality also beneficial for all groups except prime-aged men. For the group "all households", the decline in poverty was due primarily to changes in market income and for "young men" the changes were due mainly to changes in the distribution, i.e., decreased inequality. For "prime-aged men", the poverty-decreasing effect of changes in market income was sufficient to outweigh both a small poverty-increasing effect due to a decrease in transfers and a

---

17 As discussed in the text, this method will be accurate in most cases except, perhaps, for the three group-years mentionned for which the sum of all six effects diverges from the actual changes in poverty. It may nevertheless be a good approximation for the groups "all-households" 1977-81 and "young-men" 1981-82 because we can expect that the trouble in these cases occurs with the estimated value of the effect due to a change in the displacement factor c. The values for "elderly" 1977-81 should be viewed with caution. g

TABLE 2.3: Relative Effects of Changes in Growth, Transfers and Inequality on Poverty Rates, Canada

	Actual[1] percentage point change in poverty	Growth Effect: change in mean market income over needs ratio (1)	Transfer Effect: change in mean transfer income over needs ratio (2)	Inequality[2] Effect: changes in the shape of the distribution (3)
All households				
1977-81	-4.6	-3.03	-0.50	-1.07
1981-82	-2.7	1.10	-1.23	-2.57
1982-84	4.6	3.28	-0.26	1.58
Households headed by:				
Young men				
1981-82	-5.4	-0.32	-1.12	-3.96
Prime-aged men				
1977-81	-1.0	-2.13	0.11	1.02
1981-82	-2.0	1.53	-0.69	-2.84
1982-84	4.9	1.34	-0.08	3.64
Elderly				
1977-81*	-23.3	-5.84	-4.56	-12.90
1981-82	1.7	3.63	-0.74	-1.19
1982-84	-6.8	-1.58	-3.09	-2.13

* The value in this row should be viewed with caution. See the text and footnote 17 for an explanation.

Notes: [1] A positive sign (+) indicates a deterioration during the period of time considered and a negative sign (-) indicates an improvement.

[2] Column (3) is calculated as the difference between the actual percentage point change in poverty and the sum of columns (1) and (2).

larger effect due to an increase in inequality. Though the results for the group "elderly" should be viewed with care, over this period they show large beneficial effects due to all three components.

Over the period 1981-82, there was a decline in poverty for all groups except the elderly. For the group "all households", this decrease was due to a large decrease in inequality and an increase in transfers sufficient to outweigh the decrease in market income. For "young men", there was also a large decrease in inequality and a moderate increase in transfers but since there was also a slight poverty-reducing effect due to an increase in market income, this led to a larger decrease in poverty than for the "all households" group. The decrease in poverty for the group "prime-aged men" was due to a large beneficial effect of decreased inequality sufficient to outweigh the effect due to the decrease in market income. For the "elderly", the increase in poverty was due to a decrease in market income sufficient to outweigh the decreased inequality and the increase in transfers.

Over the period 1982-84, poverty increased for the "all households" and "prime-aged men" groups but decreased for the "elderly" group. The decrease for the elderly was mainly due to an increase in transfers and a reduction in inequality along with a moderate increase in market income. For the other two groups, the increase in poverty occured despite a beneficial effect due to increased transfers. This deterioration was due mainly to increased inequality in the case of the "prime-aged men" and decreased market income in the case of the "all households" group.

To summarize, the effects of changes in transfer income on poverty were beneficial and moderate throughout the period and moreover for the elderly for which the effects were larger and quite significant in reducing poverty. Growth was responsible for the decrease in poverty during 1977-81. During 1981-82, there was a sufficient decline in inequality to outweigh the decrease in market income. Finally, in

1982-84 both increased inequality and decreased market income were responsible for the rather large increase in poverty (except for the elderly).

The results obtained in this study are difficult to compare to those obtained by Gottschalk and Danziger in the American context. Though they use the same groups, they present the relative effects of growth, transfers and inequality for two different periods, namely 1967-79 and 1979-82. However, some similarities remain.

Transfers have a substantially beneficial effect on poverty only for the group of households headed by 'elderly' individuals. For the other groups, increases in transfers did reduce poverty in all years but the effect was quite moderate. One exception in our Canadian context is for the group 'prime-aged men' during the period 1977-81 where transfers decreased causing a moderate increase in poverty. In the Canadian context, growth reduced poverty for all groups in the period 1977-81. This result is similar to the one obtained in the American context for the period 1967-79 (Gottschalk and Danziger present results for only two sub-periods 1967-79 and 1979-82, making comparisons more difficult). After 1979, our results suggest that the decline in growth was responsible for a substantial increase in poverty for the period 1981-84 in Canada. In the United States, a similar result was reported for the period 1979-82.

The main difference between our results and those of Gottschalk and Danziger in the American context concerns the effects of changes in the shape of the distribution; i.e., what we refer to as the effects of changes in inequality. In the American context, such changes in the shape of the distribution have increased poverty in all periods considered, i.e., both in the 1967-79 and 1979-82 periods. Furthermore, this effect on poverty holds for all groups considered. These effects may be due to the following causes. First, it appears that increased growth is accompanied by increased inequality explaining the

joint occurence of a beneficial impact of growth per se in 1967-79 and a harmful effect on the poverty rate of the concurrent rise in inequality. The reason why the harmful effect of the decrease in growth is accompanied by increased inequality and its associated rise in the poverty rate may be due to the radical change in social policy introduced under the Reagan presidency.

The picture is rather different in the Canadian context. The pre-1982 period saw a decrease in inequality for all groups (except 'prime-aged men' in 1977-81) while the post-1982 period was characterized by increased inequality and an associated increase in the poverty rate (except for the 'elderly' group). Therefore, it appears that the relationship 'increased growth - increased inequality' does not hold in Canada. The opposite relationship seems to be the rule. The differences on this aspect between the two countries may be due to different social and fiscal policies. However, little more can be said before more studies are conducted on this particular issue.

One potentially important implication of the apparent relation between growth and inequality is that macroeconomic cyclical effects are likely to have more pronounced effects on the poverty rate, i.e., more pronounced fluctuations. Indeed it appears that growth in average income, which decreases the poverty rate, is accompanied by decreases in inequality which also reduce the poverty rate thereby increasing the initial effects. On the other hand, in a recession, where the rate of growth is decreased, the initial harmful effect on poverty is compounded by an increased inequality which also increases the poverty rate. These arguments would suggest that cyclical variations in aggregate economic activity be accompanied by larger variations in the poverty rate in Canada than in the United States where the relationship increased growth - increased inequality appears to hold.

The same reasoning suggests, however, a rather different picture for the long term. Indeed, neglecting cyclical variations, real per

capita income is increasing over the long term. The fact that increased growth is associated with decreased inequality in Canada and increased inequality in the United States seems to imply that the fight against poverty would be more easily achieved in Canada than in the United States.

These conclusions should be taken as tentative, however. First, our results in the Canadian context are based on a relatively few years of data. More estimations are needed to assess if the above-mentionned relationship holds outside our sample. Secondly, we need more studies, theoretical and empirical, explaining this relationship between growth and inequality to understand why it holds and why it is different from the American case. Only then will we be able to understand the institutional structure which causes it and be able to guide policy decisions towards strengthening the beneficial effect of these institutional features over the long term. Over the cyclical horizon, it appears that there is room for more policies directed to transfer programs to alleviate the wide cyclical fluctuations in poverty.

CHAPTER 3

THE DETERMINANTS OF POVERTY IN CANADA, 1971-1985

In the first part of this chapter, we review the relevant empirical literature. In the second, we present the model and variables used and in the third, we examine results obtained using both ordinary least squares and generalized least squares.

3.1 The literature on the determinants of poverty

Given the importance of poverty, it is not surprising to find a vast amount of literature on its nature and determinants. Given our purpose this review limits itself to papers who use econometric techniques to model changes in the poverty rate through time. Table 3.1 presents the main characteristics of the studies we identified as relevant. It shows that:

- there are no Canadian studies of this type;

- the most commonly used measure of poverty is a poverty rate calculated with respect to a given absolute threshold;[18]

- income, however measured, is always an explanatory variable; the unemployment rate is often included while transfer payments are a recent addition to these models;

- there is no unanimity as to the dependent variable (level, Δ, $\% \Delta$) and of the functional form (linear, semi-log, log-log) to be used;

- results are usually presented for all units, either families or households, and for subgroups of the population with the groupings being along the lines of sex, race, age and residence (rural/urban).

---

[18] The exceptions are Anderson (1967) who uses the median income of the poor and Hirsch (1985) who also uses a poverty-deficit index.

TABLE 3.1: Main Characteristics of (American) Studies of the Determinants of Poverty

Author	Period	Definition of poverty	Groups studied	Functional form	Dependent variables	Income	Unemployment	Transfers	Others
Anderson (1964)	1947–1960	family income less than 3,000 $ (1959 $)	families only: 8 groupings: male/female, white/non-white, farm/non-farm, -65/65+	linear/OLS	% Δ in median income	% Δ in personal real income per capita	-	-	-
Gallaway[1] (1965)	1947–1964	family income less than 3,000 $ (1959 $)	families only	linear and log-linear OLS	level and % Δ in poverty	level and % Δ in real median family income	included	-	-
Aaron[1] (1967)	(1) 1947–1964 (2) 1959–1964	family income less than 3,000 $ (1964 $)	families and households (families and unattached individuals) 7 groupings according to white/non-white, male/female, farm/non-farm	linear, semi-log, log-log/ OLS	level of poverty	median family income	included	-	-
Perl and Solnick (1971)	1947–1964	family income less than 3,000 $ (urban) or 2,000 $ (rural)	families only. 4 groupings: female, non-white, farm, 65+	linear/OLS	% Δ in poverty	% Δ in personal income per capita	-	-	-
Thornton, Agnello, Link (1978)	1947–1974	1) family income less than 3 128 $ (1963 $) 2) same ± .6 of Δ in medial family income	families only: 6 groupings: white/ non-white, male/ female, old/young	linear/OLS	Δ in poverty	% Δ in real GNP per capita	included (level, not Δ)	% Δ in real transfer payments	income x D where D = 0 1947–1963 1 1964–1974
Hirsch (1981)	1947–1974	same as above	same as above (same data set)	linear/OLS	% Δ in poverty	% Δ in real GNP per capita	included (level, not Δ)	% Δ in real transfer payments	same as above
Hirsch (1985)	1959–1975	rates calculated by Paglin (1980) to account for in-kind transfers (1975 $). A poverty deficit[2] is also used	population as a whole (person)	linear/OLS	% Δ in poverty deficit and in poverty rate	% Δ in real GNP per capita	unemployment gap (u minus natural unemployment rate	% Δ in real per capita transfers	also uses data on three types of transfers
Gottschalk and Danziger (1984)	(1) 1949–1982 (2) 1966–1982	1949–1959: derived from the 1969 Economic Report of the President 1959–1982: Census Bureau estimates	All persons and aged/non aged: white-black-hispanic male and female (6 groups)	Log-log / auto-correlation correction (level) and O.L.S.	level and difference	(1) time trend (2) real median family income (3) real GNP per household	included	real cash transfers per household	-

[1] Gallaway (1967) replies to Aaron but presents no additional regression results.
[2] This is the Δ between total income of the poor and the poverty line x number of poor.

The main findings of these studies with respect to the overall poverty rate[19] can be summarized as follows:[20]

- an increase in real income almost always reduces poverty;[21]

- an increase in unemployment sometimes increases poverty;

- an increase in real transfers sometimes reduces poverty.

These findings will influence our choice of an equation as discussed below.

3.2 The model

Given the findings of the literature summarized above and the data available for Canada, we have chosen to estimate, using data for the five regions of Canada (Atlantic, Quebec, Ontario, Prairies, B.C.) for the year 1971-1984, a pooling model with 70 observations. We will estimate it for (economic) families, (unattached) individuals and all units. The general form of the model is:

$$\text{Poverty rate} = \text{fct} \left[\begin{array}{l} (1)\ \text{economic factors (real GDP per capita, unemployment rate)} \\ (2)\ \text{transfer payments} \\ (3)\ \text{socio-demographic factors (age, divorce, participation rate of women)} \\ (4)\ \text{regional variables} \end{array} \right]$$

---

19 We do not discuss subgroups findings since in this study we focus on the poverty of all units.

20 We take into account both the signs and significance of the coefficients in this summary. Unfortunately, the use of various dependent and independent variables by the authors does not permit numerical comparisons.

21 Gottschalk and Danziger (1984) report a few positive but not significant coefficients.

We are thus using both variables commonly found in the literature (1) or recently introduced (2) and variables dictated by the use of general poverty rates (3) and pooled data (4). We will present results for all these independent variables and for subsets of these variables, using the three common (linear, semi-log, log-log) functional forms for level, first differences and growth rate variables.

We will now present our dependent and independent variables;[22] in the latter case, we will discuss the expected sign of the variables.

Dependent variables

Three dependent variables are used. They are:

- the poverty rate for economic families published by Statistics Canada;
- the poverty rate for unattached individuals published by Statistics Canada;
- the poverty rate for all units calculated by us using the two published poverty rates and the number of both types of units.

Independent variables
(expected sign)

The following variables are used:

(-) : Gross domestic product per capita, 1981 $. This variable is obtained from national accounts data. It is deflated using the Canada-wide GDP implicit price deflator and is divided by the population as a whole.

22 The exact sources, the transformations and the values of the variables are found in Appendix B.

We expect that an increase in this variable will reduce poverty, which is the usual relationship between these two variables.

(+) : Unemployment rate. This variable is used as such. We expect that an increase in unemployment will increase poverty since labour income is the main source of income of Canadians and since unemployment reduces that income.

(-) (-) : Transfers to families and transfers to individuals per capita 1981 $. These variables are constructed using data from the national accounts. They are the sum of transfer payments to individuals included under the following items: OAS/GIS, C/QPP, U.I. and family allowances (for families only), deflated using the 1981 Canadian CPI and divided by the population as a whole. Note that welfare payments are not included since a preliminary examination of the data showed that they increase with poverty. This result is not surprising since to receive welfare in Canada requires one to be poor while individuals and households whose sole source of income is welfare will be poor by definition.

(-) : Transfers per capita/GDP per capita. This modified form of the transfer variable is used to account for a possible simultaneity between transfers and GDP.

We expect an increase in transfer payments to decrease poverty since they increase the money income of recipients.

(+) : Percentage of individuals aged 15-24 in total population. Given the results of Table 1.5, we expect that an increase in this % will increase poverty at least for individuals. This results from the high sensitivity of this group to unemployment, coupled with the fact that labour earnings when entering employment or while studying are often low.

(-) : Percentage of individuals aged 65+ in total population. Given the results of Table 1.5, we expect that an increase in this % will decrease poverty. This reflects in part the increasing real value of public and private pension.

(+) : Percentage of divorced females in total population. Given the results of Table 1.5, we expect an increase in the % of divorces in the population, a proxy for female lone-parents families to increase poverty. This is explained by their lack of private income.

(-) : Participation rate of women. Given the results of Table 1.4, we expect an increase in the rate to decrease poverty, since this will increase the number of earners in the case of families.

(?) : Regional variables. This polytomous variable allows us to account for differences in regions unaccounted for elsewhere (minimum wage rate, importance of in-kind income, lifestyles, ...) and is particularly appropriate when using data pooled accross regions. The five regions are Atlantic, Quebec, Ontario (omitted), Prairies and B.C. Their expected effect is unknown.

Let us now examine the results of our multivariate analysis.

3.3 The results

In this third section of chapter three, we present and discuss our empirical results. We first examine results obtained using ordinary least squares. For the three usual explanatory variables, with and without regional variables, and with three socio-demographic variables added. We then present results obtained through the use of generalized least squares.

TABLE 3.2

Regression Results, Poverty Rates, Canada, 1971-1984
Economic and Transfer Variables, Three Functional Forms, OLS

Variables/ Statistics	Families			Individuals			All units		
	Linear (1)	Semi-log (2)	Log-log (3)	Linear (4)	Semi-log (5)	Log-log (6)	Linear (7)	Semi-Log (8)	Log-log (9)
Constant	31.86* (19.35)	3.83* (31.20)	13.95* (15.46)	74.15* (25.02)	4.67* (50.54)	12.38* (15.96)	41.39* (24.22)	4.04* (43.64)	11.74* (16.27)
GDP per capita (1981 $)	-0.00089* (-9.60)	-0.000066* (-9.56)	-0.80* (-10.03)	-0.0019* (-10.13)	-0.000056* (9.62)	-0.63* (-8.47)	-0.001* (-10.45)	-0.000053* (-10.11)	-0.60* (-9.49)
Unemployment rate	0.70* (3.43)	0.050* (3.29)	0.21* (2.19)	0.99* (2.03)	0.026* (1.71)	0.086 (0.83)	0.56* (2.64)	0.025* (2.15)	0.087 (1.15)
Transfers per capita (1981 $)	-0.019* (-5.82)	-0.0012* (-5.20)	-0.67* (5.07)	-0.037* (-4.71)	-0.001* (-4.18)	-0.49* (-3.81)	-0.020* (-5.88)	-0.0009* (-4.99)	-0.51* (-4.81)
R^2	0.71	0.70	0.71	0.75	0.72	0.65	0.74	0.71	0.69
F	57.90	54.13	57.3	69.51	60.56	44.53	66.3	57.6	51.63

t-statistics are in brackets below the coefficients.

* indicates a coefficient significantly different from zero at the 5% level using a one-tailed t-test (1.7).

We present, in Table 3.2, the impact of real per capita GDP and transfers and of the unemployment rate on poverty in Canada's five regions, calculated using three functional forms. Our main findings are that:

- the use of one functional form or another has little if any impact on our results in terms of the signs and significance of the coefficients and in terms of the overall fit of the model.

- an increase in real per capita GDP always reduces poverty in Canada.

- an increase in the unemployment rate usually (7 out of 9 cases) increases poverty in Canada.

- an increase in transfer payments always reduces poverty in Canada.

These findings are in agreement with our expectations and reinforce the results found in the literature. We will now examine how the results are first modified by using a modified measure of transfers (Table 3.3), second by using first differences rather than level variables (Table 3.3) and third by adding variables (Tables 3.4 and 3.5). The results of Table 3.3 show that the use of first differences instead of level variables, with transfers included as a ratio of GDP, lead us to the same conclusions as to the impacts of real per capita GDP and unemployment on poverty. As to transfers, they usually (7 out of 9) are of the correct negative sign. Not surprisingly, the $\bar{R}^2$ of differences equations is lower than the one found in the case of level equations. Adding regional (dummy) variables does not, as Table 3.4 shows, significantly affect these findings. One notes, however, that the fit of the model is improved and that the only region to experience a poverty level systematically and significantly higher than Ontario, once economic conditions have been controlled for is the Prairies' region. This could perhaps be due to the fact that agricultural in-kind income is not accounted for in our measure of poverty.

TABLE 3.3
Regression Results, Poverty Rates, Canada, 1971-1984
Economic and Transfer Variables, Level and First Differences, OLS

Variables/ Statistics	Families			Individuals			All units		
	Level (1)	First Difference (Level) (2)	First Difference (Log) (3)	Level (4)	First Difference (Level) (5)	First Difference (Log) (6)	Level (7)	First Difference (Level) (8)	First Difference (Log) (9)
Constant	37.5395* (14.137)	-0.08419 (-0.366)	-0.01314 (-0.724)	89.5390* (21.219)	-1.2385 (-1.642)	-0.03334 (-1.617)	49.5446* (19.500)	-0.3615 (-1.306)	-0.02241 (-1.1572)
GDP per capita	-0.001560* (-10.148)	-0.001488* (-3.786)	-1.0541* (-2.709)	-0.003294* (-12.921)	-0.001424 (-1.125)	-0.5362 (-1.223)	-0.001837* (-12.488)	-0.001452* (-3.074)	-0.7554* (-2.471)
Unemployment rate	0.1279 (0.854)	0.7116* (4.248)	0.4868 (4.437)	0.08880 (0.311)	0.2340 (0.397)	0.1027 (0.745)	0.08487 (0.592)	0.5939* (2.949)	0.2819* (3.271)
Transfers per capita/GDP per capita	-0.1002* (-4.288)	-0.1788* (-5.815)	-0.6263* (-3.862)	-0.2469* (-5.295)	0.07477 (0.587)	0.03816 (0.198)	-0.1303* (-5.827)	-0.1121* (-3.031)	-0.2766* (-2.171)
$\bar{R}^2$	0.66	0.47	0.40	0.76	0.06	0.07	0.74	0.33	0.32
F	45.50	19.81	15.49	75.60	2.46	2.56	66.08	11.46	11.05

t-statistics are in brackets below the coefficients.

* indicates a coefficient significantly different from zero at the 5% level using a one-tailed t-test (1.7).

TABLE 3.4
Regression Results, Poverty Rates, Canada, 1971-1984
Economic, Transfer and Regional Variables, Three Functional Forms, OLS

Variables/ Statistics	Families			Individuals			All units		
	Linear (1)	Semi-log (2)	Log-log (3)	Linear (4)	Semi-log (5)	Log-log (6)	Linear (7)	Semi-Log (8)	Log-log (9)
Constant	29.96* (16.26)	3.79* (31.02)	16.98* (13.84)	78.48* (15.00)	4.90* (30.80)	16.46* (11.00)	42.62* (19.75)	4.17* (37.13)	15.71* (14.68)
GDP per capita (1981 $)	-0.00084* (-5.11)	-0.000076* (-6.98)	-1.19* (-7.11)	-0.0026* (-5.55)	-0.000087* (-6.11)	-1.37* (-6.40)	-0.0014* (-7.15)	-0.000080* (-8.07)	-1.23* (-8.38)
Unemployment rate	1.10* (7.10)	0.075* (7.26)	0.38* (5.32)	0.11 (0.20)	-0.0098 (-0.60)	-0.25* (-2.40)	0.56* (3.07)	0.019* (1.97)	0.023 (0.37)
Transfers per capita (1981 $)	-0.024* (-8.67)	-0.0014* (-7.92)	-0.62* (-5.36)	-0.019* (-1.99)	-0.00031 (-1.03)	0.078 (0.51)	-0.017* (-5.32)	-0.00063* (-3.77)	-0.20* (-1.96)
Regions (Ontario omitted)									
Atlantic	2.29* (1.71)	0.055 (0.61)	-0.20 (-1.65)	-3.73 (-1.03)	-0.20* (-1.77)	-0.45* (-3.12)	-0.77 (-0.49)	-0.11 (-1.37)	-0.34* (-3.32)
Quebec	0.71 (0.94)	0.047 (0.95)	0.010 (0.18)	3.19 (1.63)	0.080 (1.35)	0.042 (0.62)	1.39 (1.58)	0.075 (1.65)	0.037 (0.74)
Prairies	4.41* (7.86)	0.37* (9.95)	0.38* (9.54)	3.83* (2.62)	0.11* (2.44)	0.075 (1.66)	4.73* (7.20)	0.26* (7.57)	0.24* (7.06)
B.C.	0.55 (1.01)	0.019 (0.51)	0.0054 (0.14)	2.00 (1.41)	0.056 (1.30)	0.049 (1.10)	2.01* (3.16)	0.11* (3.33)	0.10* (2.99)
$\bar{R}^2$	0.87	0.89	0.88	0.79	0.78	0.78	0.85	0.85	0.85
F	67.84	83.52	76.08	38.03	35.63	34.99	57.94	56.07	57.29

t-statistics are in brackets below the coefficients.

* indicates a coefficient significantly different from zero at the 5% level using a one-tailed t-test (1.7).

We indicated in section 2 of this chapter that we intended to use three socio-demographic factors to explain poverty in Canada: the age breakdown of the population and the marital and labour force participation status of women. However, preliminary estimates indicated a strong correlation between GDP per capita and the labour force participation rate of women. This resulted in GDP becoming non-significant but of the negative sign while the labour force participation rate was significant and also, as expected, negative. Given that GDP is the variable common to all past studies of this nature, we chose to exclude the labour force participation variable. We thus report in Table 3.5 the effect of our original economic, transfer and dummy variables as well as of three socio-demographic variables (two age and one divorce variable).

The introduction of socio-demographic variables:

- improves the fit of the equations ($\bar{R}^2$) only slightly.

- does not affect the signs and significance of the coefficients of the GDP variables.

- does not affect the role of the unemployment rate as an explanatory variable of the poverty of families (+) and individuals (not significant/wrong sign) but affects it for all units.

- reduces from eight to five the number of significant coefficients for the transfer variables but leaves them with the appropriate negative sign.

- the effect of the 15-24 (% of population) is mixed. It may reflect the net effect of their decision to stay or not with their parents on the family income minus the variation in the poverty threshold due to changes in family size.

TABLE 3.5

Regression Results, Poverty Rates, Canada, 1971-1984

Economic, Transfer, Socio-demographic and Regional Variables, Three Functional Forms, OLS

Variables/ Statistics	Families			Individuals			All units		
	Linear (1)	Semi-log (2)	Log-log (3)	Linear (4)	Semi-log (5)	Log-log (6)	Linear (7)	Semi-Log (8)	Log-log (9)
Constant	53.88* (6.47)	5.70* (10.32)	16.26* (6.69)	125.10* (5.64)	6.10* (9.06)	22.21* (7.22)	69.41* (7.13)	5.65* (11.15)	17.32* (7.18)
GDP per capita (1981 $)	-0.00090* (-3.15)	-0.000058* (-3.05)	-0.74* (-3.89)	-0.0042* (-5.53)	-0.00014* (-5.96)	-1.52* (-6.12)	-0.0019* (-5.75)	-0.00010* (-5.80)	-1.07* (-5.66)
Unemployment rate	0.72* (3.96)	0.056* (4.65)	0.26* (3.54)	-0.44 (-0.78)	-0.023 (-1.34)	-0.24* (-2.21)	0.25 (1.21)	0.0087 (0.79)	-0.016 (-0.22)
Transfers per capita (1981 $)	-0.021* (-7.26)	-0.0011* (-5.92)	-0.40* (-3.22)	-0.012 (-1.13)	-0.000064 (-0.195)	-.0036 (0.019)	-0.016* (-4.59)	-0.00051* (-2.87)	-0.13 (-1.07)
% of population 15-24	-0.92* (-1.86)	-0.088* (-2.67)	-1.91* (-4.32)	1.63 (1.35)	0.064* (1.76)	-0.052 (-0.09)	0.11 (0.19)	0.0039 (0.13)	-0.83* (-1.88)
% of population 65+	-0.84 (-0.99)	-0.069 (-1.22)	0.32 (0.63)	-7.95* (-3.44)	-0.25* (-3.54)	-1.62* (-2.51)	-3.03* (-3.05)	-0.18* (-3.44)	-0.48 (-0.95)
% of population divorced women	2.63 (1.06)	0.021 (0.13)	-0.23* (-1.89)	20.44* (3.19)	0.61* (3.14)	0.35* (2.27)	8.54* (2.93)	0.40* (2.63)	0.022 (0.18)
Regions (Ontario omitted)									
Atlantic	4.87* (2.77)	0.28* (2.43)	0.070 (0.53)	-8.74* (-1.83)	-0.40* (-2.78)	-0.37* (-2.04)	-0.77 (-0.37)	-0.11 (-1.06)	-0.19 (-1.49)
Quebec	1.67 (0.85)	0.15 (1.16)	0.26* (3.03)	-11.31* (-2.20)	-0.41* (-2.60)	-0.16 (-1.42)	-2.89 (-1.25)	-0.17 (-1.42)	0.067 (0.787)
Prairies	5.02* (7.77)	0.43* (10.07)	0.45* (11.81)	2.35 (1.43)	0.054 (1.08)	0.066 (1.36)	4.47* (5.92)	0.25* (6.29)	0.27* (7.17)
B.C.	0.31 (0.50)	0.048 (1.15)	0.028 (0.74)	1.05 (0.64)	0.033 (0.66)	0.071 (1.50)	1.47* (2.01)	0.10* (2.75)	0.12* (3.31)
$\bar{R}^2$	0.89	0.91	0.91	0.82	0.81	0.79	0.87	0.87	0.85
F	56.78	69.56	72.13	32.00	30.27	26.73	48.89	47.31	41.09

t-statistics are in brackets below the coefficients.

* indicates a coefficient significantly different from zero at the 5% level using a one-tailed t-test (1.7).

- the effect of the 65+ (% of population) is generally to reduce poverty (8 out of 9), as expected, but not always significantly. Its higher impact on the poverty rate of individuals may reflect the better transfer payments available to older than younger unattached individuals.

- the effect of the divorced women (% of population) is generally detrimental on poverty (8 out of 9), as expected, but not always significant. Its higher impact on the poverty rate of individuals is somewhat of a puzzle.

- finally, the Prairies remain, everything else equal, the region with the highest likelihood of poverty after standardization.

Thus the inclusion of the socio-demographic variable does not add much to our understanding of poverty in Canada's region.

The results presented above were obtained using the ordinary least squares estimation technique. The use of the technique implies strong assumption on the distribution of the error terms. These assumptions can be relaxed by:

1) estimating five poverty equations as a system of equations using OLS estimators with cross-equation restrictions.

2) using the above equations and their residuals to estimate the parameter to be used to correct for first-order autocorrelation in each regional equation.

3) reestimate the five-equation system using seemingly unrelated regression methods.[23]

---

[23] Appendix C provides a more technical description of the technique used. Because of the estimation of the first-order correlation coefficient of the errors, we lose one observation for each year and are thus left with 65 observations.

The results obtained reestimating the equations of Table 3.5, with and without socio-demographic variables are presented in Table 3.6. The main results are that:

- an increase in GDP reduces poverty in all six equations considered.

- unemployment rate variables are of the right sign and significant in the equations explaining the poverty rates of families. They are of the wrong sign in other equations.

- transfer variables are also of the right sign for families and in one case for all units.

- socio-demographic variables contribute little to the explanation of poverty.

- poverty rates differ between regions.

Generally, the results obtained using this alternative statistical procedure are comparable to those obtained using ordinary least squares.[24] However, the advantage is that they yield more precise estimates, and provide additional evidence on the relevant problems.

---

[24] Results using first differences and/or transfer/GDP variables, which are not reported here, support this conclusion.

TABLE 3.6

Regression Results, Poverty Rates, Canada, 1971-1984 Economic, Transfer, Socio-demographic and Regional Variables, Linear Functional Form, GLS

Variables/Statistics	Families (1)	Families (2)	Individuals (3)	Individuals (4)	All units (5)	All units (6)
GDP per capita (1981 $)	-0.00095* (-8.90)	-0.00045* (-3.71)	-0.0030* (-9.74)	-0.0031* (-5.57)	-0.0019* (-15.58)	-0.0017* (-9.29)
Unemployment rate	0.71* (4.89)	0.52* (5.87)	-1.27* (-2.74)	-2.11* (-4.97)	-0.37* (-2.27)	-0.27* (-3.91)
Transfers per capita (1981 $)	-0.013* (-3.70)	-0.0099* (-4.23)	0.014 (1.53)	0.031* (2.96)	0.011* (2.76)	-0.0017 (-1.39)
Regions						
Atlantic	12.38* (12.64)	27.62* (10.26)	22.24* (13.74)	43.26* (4.65)	10.38* (11.13)	28.72* (18.15)
Quebec	14.42* (14.60)	44.65* (11.36)	39.86* (22.38)	77.90* (5.80)	16.45* (17.88)	70.73* (23.59)
Ontario	25.23* (14.29)	29.41* (10.06)	26.31* (16.66)	50.72* (5.54)	18.80* (17.46)	38.65* (19.60)
Prairies	30.36* (15.85)	64.37* (10.98)	58.91* (18.58)	48.49* (5.75)	37.60* (20.68)	52.22* (21.93)
B.C.	12.68* (12.86)	22.63* (10.04)	100.48* (19.49)	87.59* (5.50)	31.51* (17.64)	44.59* (19.56)
% of population 15-24	- -	-1.83* (-6.76)	- -	-0.011 (-0.013)	- -	-0.99* (-3.19)
% of population 65+	- -	0.69 (1.36)	- -	-1.09 (-0.75)	- -	-0.27 (-0.39)
% of population divorced women	- -	-4.42* (-3.44)	- -	3.73 (0.77)	- -	1.05 (0.59)
R^2	0.69	0.89	0.71	0.96	0.82	0.95

t-statistics are in brackets below the coefficients.

* indicates a coefficient significantly different from zero at the 5% level using a one-tailed t-test (1.7).

CHAPTER 4

CONCLUDING COMMENTS AND POLICY IMPLICATIONS

Our study has isolated a few empirical regularities which are of importance with respect to policy decisions. Of course no definitive answers to some important policy questions can be given based on the short sample of data that was available. The following implications should therefore be regarded as tentative and in need of further empirical verifications. However, we think some results are interesting enough to warrant some directives to both policy measures and further empirical analyses.

First, both the approaches of chapters 2 and 3 showed the importance of the rate of growth in aggregate activity in influencing the rate of poverty for all groups considered. Indeed the overall change in the average income or in the level of GNP is the most significant factor explaining changes in the poverty rate. As the results in chapter 3 illustrate, this fact remains even taking unemployment and transfers as fixed. Therefore, growth has an independent influence of itself in lifting households out of poverty. This empirical regularity accords well with previously available evidence; see, for example, Abramowitz (1981). Given the short span of data that is available in the Canadian case, we were not able to provide some answers to an important policy question, namely whether the beneficial impact of growth has declined during the post-war period. Nevertheless, our results indicate that the effect of growth is still significant in the 70s and 80s. Therefore, even if there has been a weakening in its beneficial effects, growth can still be relied upon to alleviate some proportion of the existing poverty.

However, changes in real aggregate economic activities are not a one-way ticket. Just as positive growth has a substantial beneficial impact on poverty, so does reduction in growth have a harmful effect. Indeed our results show the importance of cyclical variations in GNP in explaining variations in poverty rates. Cyclical recessions are directly associated with increases in the poverty rates. Therefore, though the

growth of economic activity can be relied upon to alleviate poverty in the long term, it must be supplemented by other means over shorter horizons. This fact is supported by the statistical effect of unemployment on the poverty rates. Indeed, the unemployment rate is generally associated directly with the poverty rate, though the effects are not as unambiguous and significant as they are for the level of gross national product.

An interesting empirical regularity that emerged from the results of chapter 2 is that, unlike the American case, cyclical recoveries seem to be associated with decreased inequality while cyclical recessions are accompanied with increased inequality in the distribution of income. As mentionned in chapter 2, this implies a greater cyclical variation in the poverty rate than would be the case if the income distribution remained unchanged. These compounding effects are beneficial over cyclical recoveries but more harmful over cyclical downturns. Over the long term, the joint effects are beneficial as growth is accompanied by decreased inequality, thereby facilitating the beneficial impact of growth.

Of course, more work is needed to evaluate this important empirical regularity. First, more empirical studies are needed to evaluate its accuracy and its importance for other periods and other data sets.[25] Secondly, more work is needed to analyse why such a relation between growth and inequality should hold in the Canadian context and not be present in the American case. The answer probably lies in the different institutional structure and the different conducts of social policies in each country. More work is needed to analyse these differences to accurately evaluate the impact of various policies directed at alleviating the rate of poverty.

During cyclical downturns, these compounding harmful effects, due to decreased growth and increased inequality, highlight the role for more aggressive social policies during recessions based, for example, on transfer measures. Indeed, another empirical regularity that emerges from the present study is that, though transfers have had a beneficial

---

25 This will become increasingly feasible as SCF microdata files should be produced on an annual basis from 1984 onwards.

impact on the poverty rate, their effects were moderate and well below the effects induced by growth and inequality. Furthermore, the effects of governmental transfers were not significantly different in times of cyclical expansions and cyclical downturns. This implies that transfers have not played any role in alleviating the cyclical variations in the poverty rate. The only significant impact they had was in alleviating the poverty rate for the group of households headed by an elderly person. This fact is important in itself because it shows that transfer policies can indeed have a significant impact. However, this result is obtained for a group with a low labour force participation rate.

The present study highlights the need for more counter-cyclical social policies to reduce the cyclical fluctuations in the poverty rate due to cyclical variations in aggregate economic activities. This is not an easy policy measure to implement. It is indeed during cyclical expansions that it is more easily feasible to introduce transfers, and it is during cyclical downturns that it is most difficult. Counter-cyclical policies have never been an easy thing to implement for any government. Standard macroeconomic analyses point to the use of the budget balance to implement the necessary intertemporal transfer of resources. A budget deficit during a recession permits an intertemporal transfer of resources from good times to more difficult periods and therefore alleviates the need to enforce transfer measures between different groups during a period which can be difficult for a majority of households.

This policy recommendation appears straightforward enough. However, the budget balance has clearly lost its role as a counter-cyclical device in the recent past, having shown an increasingly large deficit figure. This makes it more difficult to carry on the needed governmental transfers to alleviate poverty during recessions.

The above arguments highlight the fact that problems related to poverty, their resolutions and the financing of the associated measures are intimately related to the overall problems of general governmental finances and the role of the overall budget balance.

BIBLIOGRAPHY

Aaron, Henry, "The Foundations of the 'War on Poverty' Reexamined", The American Economic Review, December 1967, Vol. 57, pp. 1229-1240.

Abramovitz, Moses, "Welfare Quandaries and Productivity Concerns", American Economic Review, 1981, Vol. 71, pp. 1-17.

Anderson, W.H. Locke, "Trickling Down: The Relationship Between Economic Growth and the Extent of Poverty Among American Families", Quarterly Journal of Economics, November 1964, Vol. 78, pp. 511-524.

Buse, A. (1979), "Goodness-of-Fit in the Seemingly Unrelated Regressions Model: A Generalization", Journal of Econometrics, Vol. 10, pp. 109-114.

Danziger, S. and P. Gottschalk (1986), "Do Rising Tides Lift all Boats? The Impact of Secular and Cyclical Changes on Poverty", American Economic Review, Papers and Proceeding, Vol. 76, No. 2, pp. 405-410.

Gallaway, Lowell E., "The Foundations of the 'War on Poverty'", The American Economic Review, March 1965, Vol. 55, pp. 122-131.

Gottschalk, P. and S. Danziger (1984), "Macroeconomic Conditions, Income Transfers and the Trend in Poverty", in The Social Contract Revisited, ed. D.L. Bowden, Washington: Urban Institute Press, 1984.

_____ (1985), "A Framework for Evaluating the Effects of Economic Growth and Transfers on Poverty", American Economic Review, Vol. 75, pp. 153-161.

Hirsh, Barry T., "Poverty and Economic Growth: Has Trickle Down Petered Out?", Economic Inquiry, January 1980, pp. 151-98.

_____ "Poverty, Transfers and Economic Growth", Public Finance Quarterly, January 1985, Vol. 13, No. 1, pp. 81-98.

Judge, G.G., W.E. Griffiths, R.C. Hill and T.C. Lee (1980), The Theory and Practice of Econometrics, Wiley: New York.

McElroy, M.B. (1977), "Goodness of Fit for Seemingly Unrelated Regressions: Glahn's $R^2_{y.x}$ and Hooper's $\bar{r}^2$", Journal of Econometrics, Vol. 6, pp. 381-387.

Perl, Lewis J. and Loren M. Solnick, "A Note on 'Trickling Down'", Quarterly Journal of Economics, February 1971, Vol. 85, pp. 171-178.

Ross, D. (1984), Canadian Fact Book on Poverty, Ottawa: Canadian Council on Social Development.

Thornton, James R., Richard J. Agnello and Charles R. Link, "Poverty and Economic Growth: Trickle Down Peters Out", Economic Inquiry, July 1978, Vol. 16, pp. 385-393.

APPENDIX A: Data Sources and Variables used in Chapter 2

Year	Data Source	Population Size (weighted) 1. All households 2. Hhlds. headed by a male < 25 3. Hhlds. headed by a male between the ages of 25 and 64 4. Hhlds. headed by a male or female > 65 5. Hhlds. headed by a female < 25 6. Hhlds. headed by a female between the ages of 25 and 64	Market Income (numbers in parenthesis refer to field on the microdata file	Transfer Income	Poverty Line (established with areas of residence and family size. Based on 1969 year and revised with CPI of each year)
1977	Survey of Consumer Finances, 1978. Economic families, 1977 income. Statistics Canada.	1. 8,157,690 2. 584,710 3. 4,946,870 4. 1,334,820 5. 327,390 6. 963,940	sum of total earnings (69-54), net income from investment (55-60), retirement pensions, superannuation and annuities (115-120), other money income (121-126)	total government transfer payments (97-102)	the areas of residence number 1 (500,000+ inhabitants) and number 2 (100,000-499,999 inhabitants) have been regrouped. The poverty line is the one for the second area here and for all years
1981	Survey of Consumer Finances, 1982. Economic families, 1981 income. Statistics Canada.	1. 8,953,340 2. 541,400 3. 5,411,550 4. 1,535,600 5. 309,450 6. 1,155,340	sum of total earnings (55-61), net income from investment (62-68), retirement pensions, superannuation and annuities (139-145), other money income (146-152)	total government transfer payments (118-124)	idem 1977
1982	Survey of Family Expenditures in 1982. Statistics Canada.	1. 7,731,610 2. 278,146 3. 4,570,412 4. 1,389,306 5. 180,679 6. 1,313,067	sum of income from wages and salaries (176-182), income from self-employment (183-189), income from investment (190-196), income from other sources	income from government transfer payments (197-203)	poverty line of 1981 adjusted with the CPI of 1982 (1.108)
1984	Survey of Consumer Finances, 1985. Economic families, 1984 income. Statistics Canada.	1. 9,433,780 2. 494,260 3. 5,676,430 4. 1,662,210 5. 303,890 6. 1,296,990	sum of total earnings (55-61), net income from investment (62-68), retirement pensions, superannuation and and annuities (139-145), other money income (146-152)	total government transfer payments (118-124)	idem 1977 and 1981

APPENDIX B: Data sources for Chapter 3

1. Poverty rates of families and unattached individuals: were taken from "Income Distributions by Size in Canada", Statistics Canada, Cat. 13207.

Data for 1971, 1973, 1975, 1977, 1979, 1980, 1981, 1982, 1983, 1984 are estimates based on low income cutoffs established in 1969, Cat. 13-207, 1984, pp. 172-173.

Data for 1972 are estimates based on low income cutoffs established in 1961, Cat. 13-207, 1972, p. 95.

Data for 1974 are estimates based on low income cutoffs established in 1961, Cat. 13-207, 1974, p. 100.

Data for 1976 are estimates based on low income cutoffs established in 1961, Cat 13-207, 1976, p. 103.

Data for 1978 are estimates based on low income cutoffs established in 1961, Cat 13-207, 1978, p. 103.

Estimates based on low income cutoffs established in 1961 were transformed to be comparable with data based on 1969 base. For example, the 1972 Atlantic families' poverty rate was obtained as follows:

Data for 1971 = 27.7 (1969 base)
Data for 1971 = 26.4 (1961 base, Cat. 13-207, 1971, p. 72)
Data for 1972 = 20.8 (1961 base)

$$\frac{27.7 \times 20.8}{26.4} = 21.8 = \text{data for 1972, 1969 base.}$$

2. Number of families and unattached individuals: data were taken from "Income Distributions by Size in Canada", Statistics Canada, Cat. 13-207.

Data for	Were taken from Cat. 13-207, Year	PAGES	
		Families	Unattached individuals
1971	1971	20-21	45
1973	1973	24-25	54
1975	1975	26-27	56
1977	1977	38-39	70
1979	1979	34-35	66-67
1981	1981	46-47	76-77
1982	1982	44-45	74-75
1984	1984	48-49	78-79

Missing data were estimated by the mean between the preceding and the following year of the missing value.

3. Global poverty rates: data were calculated as the weighted mean of the "unattached individuals" and "families'" rates with the weights being the number of these units.

4. Population: data were taken from Cat. 91-201, and Cat. 91-210.

Data for 1971 to 1981 were taken from Cat. 91-201, 1983, p. 13.

Data for 1982, 1983 and 1984 were taken from Cat. 91-210, 1986, p. 39.

5. Implicit price indexes for gross domestic product: data were taken from "National Income and Expenditure Accounts", Statistics Canada, Cat. 13-001.

Data for 1971 and 1972 were taken from Cat. 13-001, fourth quarter 1972, pp. 58-59 (1961 = 100 base).

Data for 1973 to 1980 were taken from Cat. 13-001, fourth quarter 1980, pp. 64-65 (1971 = 100 base).

Data for 1981 to 1984 were taken from Cat. 13-001, fourth quarter 1986, pp. 40-43 (1981 = 100 base).

Data for 1971 to 1980 were transformed to be comparable with data for 1981 to 1984 (1981 = 100).

6. Consumer price indexes: data were taken from "Consumer Prices and Price Indexes", Statistics Canada, Cat. 62-010 quarterly, July-September, 1986, p. 32.

7. Transfer payments: data for family and youth allowances, unemployment insurance benefits, old age security fund payments and Canada/Quebec pension plan payments were taken from "Provincial Economic Accounts", Statistics Canada, Cat. 13-213, 1969-1984, pp. 132-151 and were added together. All data were deflated by the consumer price index.

8. Provincial gross domestic product (at market price): data were taken from "Provincial Economic Accounts, Statistics Canada, Cat. 13-213, 1969-1984, pp. 4-23. All data were deflated by the implicit price index, gross domestic product.

9. Unemployment (unadjusted series): data were taken from "Historical Labour Force Statistics - Actual Data, Seasonal Factors, Seasonally Adjusted Data", Statistics Canada, Cat. 71-201, 1986, pp. 174-185.

10. Labour force (unadjusted series): data were taken from "Historical Labour Force Statistics - Actual Data, Seasonal Factors, Seasonally Adjusted Data", Statistics Canada, Cat. 71-201, 1986, pp. 46-57.

11. Unemployment rates were calculated as follows:

$$\frac{\text{unemployment}}{\text{labour force}} \times 100$$

12. Number of divorced females: data were taken from "Revised Annual Estimates of Population by Marital Status, Age, and Sex for Canada and the Provinces", Cat. 91-519, 1971-1976; "Intercensal Annual Estimates of Population by Marital Status, Age and Sex for Canada and the Provinces", Cat. 91-519, 1971-1976 and "Postcensal Annual Estimates of Population by Marital Status, Age, Sex and Components of Growth for Canada, Provinces and Territories", Statistics Canada, Cat. 91-210, 1982-1983 and 1984.

Data for 1971 to 1977 were taken from Cat. 91-519, pp. 18-37.

Data for 1978 to 1981 were taken from Cat 91-519 pp. 31-92.

Data for 1982 and 1983 were taken from Cat. 91-210, pp. 52-61 and pp. 65-74.

Data for 1984 were taken from Cat. 91-210, p. 37-46.

13. Number of individuals aged 65 or more: data were taken from "Population", Cat. 91-518, 1971-1976 and 1976-1981 and from "Postcensal Annual Estimates of Population by Marital Status, Age, Sex and Components of Growth for Canada, Provinces and Territories", Statistics Canada, Cat. 91-210, 1982-1983 and 1984.

Data for 1971 to 1976 were taken from Cat. 91-518, pp. 31, 37, 43, 49, 55 and 61.

Data for 1977 to 1981 were taken from Cat. 91-518, pp. 31, 37, 43, 49 and 55.

Data for 1982 and 1983 were taken from Cat. 91-210, pp. 45 and 51.

Data for 1984 were taken from Cat. 91-210, p. 35.

14. Number of individuals aged 15 to 24: data were taken from "Population", Cat. 91-518, 1971-1976 and 1976-1981 and from "Postcensal Annual Estimates of Population by Marital Status, Age, Sex and Components of Growth for Canada, Provinces and Territories", Statistics Canada, Cat. 91-210, 1982-1983 and 1984.

Data for 1971 to 1976, 16-24 years category, were taken from Cat. 91-518, pp. 31, 37, 43, 49, 55 and 61.

Data for 1971 to 1976, 15 years category, were taken from Cat. 91-518, pp. 30, 36, 42, 48, 54 and 60.

Data for 1976 to 1981, 16-24 years category, were taken from Cat. 91-518, pp. 31, 37, 43, 49 and 55.

Data for 1976 to 1981, 15 years category, were taken from Cat. 91-518, pp. 30, 36, 42 and 48.

Data for 1971 to 1981, 15-24 category, are the sums of the 16-24 years and 15 years categories.

Data for 1982 and 1983, 15-19 years category, were taken from Cat. 91-220, pp. 44 and 50.

Data for 1982 and 1983, 20-24 years category, were taken from Cat. 91-210, pp. 44 and 50.

Data for 1982 and 1983, 15-24 category, are the sums of the 15-19 years and 20-24 years categories.

Data for 1984, 15-19 years category, and 20-24 years category were taken from Cat. 91-210, p. 34.

Data for 1984, 15-24 years category, are the sums of the 15-19 years and 20-24 years categories.

TABLE B-1

REGIONAL POVERTY RATES, 1969 LOW-INCOME CUTOFFS: FAMILIES (%)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	27.7000	20.7000	13.5000	22.3000	15.0000
1972	21.8000	18.0000	12.2000	18.7000	13.6000
1973	19.0000	15.4000	10.7000	16.5000	8.90000
1974	16.2000	13.9000	8.50000	13.2000	7.90000
1975	15.2000	13.3000	9.70000	13.8000	10.0000
1976	14.1000	12.1000	9.70000	11.4000	11.0000
1977	13.6000	12.7000	9.80000	11.5000	10.4000
1978	14.5000	12.0000	8.80000	10.2000	8.30000
1979	13.3000	11.4000	9.30000	11.2000	8.60000
1980	12.9000	12.1000	8.10000	9.40000	7.50000
1981	12.8000	11.3000	7.70000	8.80000	7.60000
1982	13.0000	12.0000	8.70000	9.10000	9.40000
1983	14.2000	12.6000	9.20000	10.9000	10.0000
1984	13.4000	12.9000	9.00000	11.5000	12.2000

TABLE B-2

REGIONAL POVERTY RATES, 1969 LOW-INCOME CUTOFFS: UNATTACHED INDIVIDUALS (%)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	51.5000	44.9000	38.0000	43.4000	48.0000
1972	54.0000	40.2000	36.5000	44.1000	34.8000
1973	44.9000	40.8000	37.7000	45.5000	37.1000
1974	44.1000	44.1000	33.9000	38.6000	30.7000
1975	45.2000	45.1000	33.4000	37.1000	35.8000
1976	38.7000	40.4000	32.5000	34.5000	26.4000
1977	45.2000	40.6000	34.1000	35.5000	34.5000
1978	41.8000	36.4000	34.9000	33.0000	31.6000
1979	32.8000	39.3000	30.3000	26.5000	26.1000
1980	33.7000	35.7000	25.5000	26.3000	28.8000
1981	29.0000	37.7000	22.4000	21.0000	25.1000
1982	29.5000	37.1000	23.3000	21.3000	25.5000
1983	29.6000	38.1000	26.0000	24.6000	24.9000
1984	27.9000	37.1000	22.3000	22.5000	26.8000

TABLE B-3

REGIONAL POVERTY RATES, 1969 LOW-INCOME CUTOFFS: ALL UNITS (%)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	33.2464	26.6673	19.4569	27.9242	24.7034
1972	29.0048	23.7113	18.3644	25.6052	19.9188
1973	24.5595	22.1927	17.8192	24.5374	17.4113
1974	22.4025	22.0372	15.3671	20.4377	15.1258
1975	22.0799	21.9279	16.2536	20.6035	18.5178
1976	19.9057	19.5648	15.9994	18.3481	16.1672
1977	21.2564	19.8552	16.5085	18.9110	18.6750
1978	21.2808	18.4003	16.2076	17.3729	16.3830
1979	18.2576	18.8764	15.4168	16.7374	15.4298
1980	17.8621	18.4968	13.0319	14.7432	14.6970
1981	16.4126	18.5315	11.7544	12.6130	13.3110
1982	16.7068	19.1406	12.7887	12.9788	14.7100
1983	17.6327	19.8674	13.8606	15.2077	14.9667
1984	16.6069	19.8088	12.6555	14.9202	17.1168

TABLE B-4

REGIONAL GDP PER CAPITA (1981 DOLLARS)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	6788.48	9604.07	12673.0	10660.0	11543.4
1972	7178.06	10134.7	13391.4	11174.7	12296.3
1973	7608.91	10547.1	13926.8	12642.7	13621.4
1974	7539.89	10734.4	13920.9	14400.8	13479.9
1975	7560.23	10766.2	13605.6	14873.6	13116.3
1976	7937.17	11446.6	14155.6	15061.6	14038.9
1977	8072.22	11497.5	14256.6	15221.8	14442.9
1978	8445.81	12060.8	14545.8	16121.2	14935.5
1979	8874.49	12101.1	14766.2	16967.1	15484.8
1980	8015.38	12139.1	14765.4	17866.6	15506.6
1981	8395.70	12428.2	15267.8	18290.1	15740.5
1982	8504.01	11905.2	14457.9	17431.3	14627.0
1983	9027.62	12153.1	15033.9	17518.5	14652.2
1984	9490.40	12598.9	15842.9	17993.9	14768.8

TABLE B-5

REGIONAL PER CAPITA TRANSFERS TO FAMILIES (1981 DOLLARS)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	481.467	392.730	416.832	427.467	467.512
1972	627.337	516.876	513.619	513.138	614.718
1973	677.433	562.975	527.548	527.814	641.457
1974	810.490	674.341	605.282	582.333	711.114
1975	900.438	762.716	680.439	593.783	801.589
1976	950.966	796.392	674.057	607.622	781.184
1977	1011.74	844.185	686.207	630.149	794.300
1978	1038.13	877.944	709.331	645.039	822.883
1979	952.038	801.682	662.192	600.509	750.845
1980	969.471	800.565	692.134	608.393	731.623
1981	987.466	817.620	691.270	614.632	733.183
1982	1098.67	959.382	807.150	717.713	950.029
1983	1166.23	985.997	862.891	828.121	1029.72
1984	1207.81	1006.57	841.307	845.084	1047.72

TABLE B-6

REGIONAL PER CAPITA TRANSFERS TO UNATTACHED INDIVIDUALS (1981 DOLLARS)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	404.294	331.010	348.539	354.550	400.260
1972	554.366	459.321	449.887	445.185	553.145
1973	604.494	501.113	458.749	454.669	574.848
1974	641.786	525.862	459.723	427.357	569.210
1975	735.133	615.540	536.947	441.756	661.785
1976	800.123	664.807	542.862	468.437	653.565
1977	862.895	714.112	557.852	493.325	669.969
1978	895.338	749.119	585.711	513.091	702.591
1979	852.647	714.301	576.193	508.620	667.099
1980	873.079	718.306	609.309	519.766	651.035
1981	895.255	741.046	612.195	530.271	656.293
1982	1007.68	880.270	728.972	632.713	873.392
1983	1077.88	909.456	786.415	743.734	954.097
1984	1120.72	932.111	765.963	760.835	972.187

TABLE B-7

REGIONAL UNEMPLOYMENT RATES (%)

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	6.53789	7.28590	5.41033	5.17483	7.23026
1972	7.62590	7.46958	5.01466	5.30612	7.78252
1973	7.32700	6.76271	4.30351	4.59921	6.68693
1974	7.95306	6.57588	4.44927	3.36294	6.15385
1975	9.78399	8.08462	6.33840	3.97554	8.46366
1976	10.8344	8.66493	6.15662	4.14720	8.59445
1977	12.5457	10.2899	6.97441	4.81793	8.53659
1978	12.4706	10.8489	7.21026	5.18439	9.23627
1979	11.5959	9.59613	6.50901	4.30328	7.66747
1980	11.0738	9.83936	6.82759	4.31161	6.76403
1981	11.4790	10.3289	6.56362	4.49859	6.68626
1982	14.2699	13.7759	9.76043	7.57576	12.1168
1983	14.9784	13.9133	10.3720	9.74405	13.8229
1984	15.3927	12.8082	9.06359	9.83972	14.7518

TABLE B-8

REGIONAL PERCENTAGES OF INDIVIDUALS AGED 65 OR MORE

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	8.34000	6.85000	8.37000	8.73000	9.38000
1972	8.38000	7.03000	8.46000	8.85000	9.42000
1973	8.45000	7.20000	8.57000	8.96000	9.48000
1974	8.55000	7.36000	8.65000	9.05000	9.53000
1975	8.65000	7.52000	8.75000	9.09000	9.62000
1976	8.78000	7.72000	8.94000	9.17000	9.82000
1977	8.97000	7.92000	9.15000	9.22000	10.0400
1978	9.20000	8.14000	9.35000	9.29000	10.2600
1979	9.44000	8.38000	9.60000	9.40000	10.5100
1980	9.67000	8.60000	9.85000	9.46000	10.7200
1981	9.93000	8.84000	10.0600	9.49000	10.8600
1982	10.1400	9.05000	10.2400	9.50000	11.0500
1983	10.2600	9.28000	10.3700	9.65000	11.2900
1984	10.4000	9.43000	10.4800	9.78000	11.5400

TABLE B-9

REGIONAL PERCENTAGES OF INDIVIDUALS AGED 15-24

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	19.4400	19.4200	18.0100	18.3400	17.6800
1972	19.5200	19.5800	18.0000	18.5200	17.8200
1973	19.6300	19.7900	18.1000	18.7900	18.0500
1974	19.7000	20.0100	18.3400	19.1900	18.3300
1975	19.8400	20.1800	18.5400	19.5600	18.5100
1976	20.0700	20.2900	18.7800	19.8900	18.6200
1977	20.0300	20.3000	18.8400	20.2300	18.5800
1978	20.0200	20.3000	18.8700	20.4100	18.5800
1979	19.9900	20.1900	18.8500	20.4300	18.4500
1980	19.8400	19.9800	18.7500	20.3600	18.2100
1981	19.6200	19.6300	18.5300	20.1500	17.8800
1982	19.3200	19.0600	18.2100	19.6900	17.4500
1983	19.0900	18.4300	17.8300	19.0600	17.0000
1984	18.9600	17.7500	17.4800	18.2900	16.5800

TABLE B-10

REGIONAL PERCENTAGES OF DIVORCED FEMALES

YEAR	ATLANTIC	QUEBEC	ONTARIO	PRAIRIES	BRITISH COLUMBIA
1971	.250000	.240000	.540000	.560000	.890000
1972	.300000	.320000	.600000	.620000	.950000
1973	.330000	.400000	.650000	.670000	1.03000
1974	.390000	.490000	.710000	.730000	1.09000
1975	.420000	.570000	.770000	.790000	1.17000
1976	.470000	.660000	.830000	.850000	1.24000
1977	.530000	.770000	.900000	.920000	1.32000
1978	.600000	.890000	.970000	.980000	1.41000
1979	.680000	1.00000	1.04000	1.04000	1.49000
1980	.740000	1.12000	1.12000	1.11000	1.58000
1981	.820000	1.24000	1.19000	1.18000	1.67000
1982	.910000	1.47000	1.30000	1.31000	1.79000
1983	1.05000	1.73000	1.42000	1.48000	1.96000
1984	1.17000	1.87000	1.52000	1.58000	2.03000

APPENDIX C: A Multivariate Model with a Panel of Data

We describe, in this appendix, the multivariate estimation procedure used to analyse the effect of aggregate variables on the poverty rate. Our data set consists of a panel of data with 5 Canadian regions and 14 years of data for each region. We therefore have a total of 70 observations. For each region, we have a time series of observations on aggregates such as the poverty rate, the gross domestic product, the unemployment rate, the total amount of transfers and various demographic variables. With panel data, the most general model can be written as

$$(A1) \qquad Y_{it} = \beta_{1it} + \sum_{k=2}^{K} \beta_{kit} X_{kit} + \epsilon_{it}$$

where $i = 1, \ldots, 5$ refers to an index associated with each region and $t = 1, \ldots, 14$ refers to the time index. Y_{it} is the dependent variable, here the poverty rate, for region i at time t, and X_{kit} is the k^{th} explanatory variable (there are $K - 1$ explanatory variables and a constant).

Given our limited number of observations, model (A1) is too general to be estimated. We need to impose some restrictions. The first one is to restrict the slope coefficients to be equal across regions and to be time invariant, i.e., $\beta_{kit} = \beta_k$ for all i and t. This means, for example, that we impose the effect of a change in regional GDP on poverty to be the same across regions. While this may seem restrictive, it is obviously necessary given the available data set. Furthermore the principal reason for using a regional panel of data in the first place was to be able to have more observations to estimate national effects. It seems therefore appropriate to impose those restrictions.

A second possible restriction is to impose a time invariant intercept, i.e., $\beta_{1it} = \beta_{1i}$ for all t. These two restrictions will be imposed throughout and lead to the model:

$$(A2) \qquad Y_{it} = \beta_{1i} + \sum_{k=2}^{K} \beta_k X_{kit} + e_{it} \qquad \begin{matrix} i = 1, \ldots, 5 \\ t = 1, \ldots, 14 \end{matrix} .$$

This model is referred to as the "panel data model with constant slope coefficients and an intercept that varies over individuals" (see, for example, Judge, Griffiths, Hill and Lee (1980), Section 8.3). The differences in the various estimation procedures presented in the text arise from the treatment of the stochastic structure of the error term.

When estimating models with a panel of data, two possible postulates can be made with respect to the nature of the coefficients, i.e., that they are random or fixed. The appropriate assumption to make here is that the coefficients are fixed. One usually postulates a random coefficient when the sample of "individuals" or regions is only a subset of a larger population. However, the 5 regions considered here make up for the total population of Canada.

A first possible postulate on the structure of the error term is to suppose that they are uncorrelated both over time and across regions, i.e., $E(e_i e_i') = \sigma_i^2 I_T$ and $E[e_i e_j'] = 0$ $(i \neq j)$ where e_i is the $T \times 1$ vector of residuals for region i. In this case, the model (A2) can be written as:

$$(A3) \qquad Y_t = c + c_1 d_1 + c_2 d_2 + c_3 d_3 + c_4 d_4 + \sum_{k=2}^{K} \beta_k X_{kt} + e_t$$

where $Y_t' = (Y_{1t}, Y_{2t}, Y_{3t}, Y_{4t}, Y_{5t})$ is a 1×5 vector of the dependent variables. d_i is a dummy which takes the value 1 for regions i and 0 otherwise and $X_{kt}' = (X_{k1t}, \ldots, X_{k5t})$ is a 1×5 vector for the k^{th} explanatory variable. c is a constant term. Given that the error terms are uncorrelated, (A3) can be efficiently estimated by ordinary least squares techniques. This estimation procedure is used in the first part of section 3.

The assumption that the errors are uncorrelated may appear overly stringent in our context. Indeed it is plausible to expect at least some

correlation in the shocks across regions and probably some correlation in the shocks over time. To take account of this possible structure we also estimate a model where we allow the errors to be correlated across regions and to follow an autoregressive process of order one over time. That is:

(A4) $$e_{it} = \rho_i e_{i,\, t-1} + v_{it}$$

with $$E[v_{it}\, v_{jt}] = \sigma_{ij}$$

and $$E[v_{it}\, v_{is}] = 0 \quad \text{for } t \neq s.$$

Note that we allow a different autoregressive parameter for each region. Our model is therefore described by (A2) and (A4).

To estimate this model we proceed as follows. Note first that we cannot estimate each equation of (A2) separately by least squares to obtain an estimate of the correlation of the errors because we have cross equation restrictions, namely that the slope parameters are identical across regions. Therefore in a first step we apply a multivariate procedure to estimate (A2) imposing the errors to be uncorrelated both over time and across regions (TSP procedure LSQ with an equation for each region imposing a diagonal covariance matrix). We then estimate the autoregressive parameter for each equation using the computed residuals as:

$$\hat{\rho}_i = \frac{\sum_{t=2}^{T} \hat{e}_{it}\hat{e}_{i,\, t-1}}{\sum_{t=2}^{T} \hat{e}^2_{i,\, t-1}} \qquad i = 1, \ldots 5 .$$

Using these estimates, we transform each observation (both the dependent and explanatory variables, except the constant) as follows:

$$Y^*_{it} = Y_{it} - \hat{\rho}_i Y_{i,\, t-1} \qquad i = 1, \ldots, 5$$

$$X^*_{it} = X_{it} - \hat{\rho}_i X_{i,\, t-1} \qquad t = 2, \ldots, 14$$

Note that by applying this transformation we lose one observation for each region so that our effective number of observations is now 13 × 5 = 65. Next, we construct the model:

$$(A5) \qquad Y^*_{it} = \beta_{1i} + \sum_{k=2}^{K} \beta_k X^*_{kit} + e^*_{it}$$

where now e^*_{it} is uncorrelated over time, i.e., $E[e_i e'_j] = \sigma_{ij} I_T$, a diagonal matrix. This model can be estimated by the "seemingly unrelated regression" technique imposing cross equation restrictions. The results of this procedure are the ones presented in the text.

Finally, note that the individual R^2 for each equation does not have any sensible interpretation because of the multivariate nature of the estimation technique as well as the cross equation restrictions and the structure of the covariance matrix of the residuals. The R^2 presented in the text is a "generalized goodness-of-fit measure" valid in a multivariate model. It is computed as:

$$R^2 = 1 - \frac{M}{tr[\Sigma^{-1} M_{yy}]}$$

where M is the number of equations, tr[.] is the trace operator,

$$\Sigma_{ij} = \frac{1}{T} \sum_{t=1}^{T} \hat{e}^*_{it} \hat{e}^*_{jt}$$

$$M_{yy,ij} = \frac{1}{T} \sum_{t=1}^{T} (Y_{it} - \bar{Y}_i)(Y_{jt} - \bar{Y}_j)$$

Useful references on this measure can be found in Buse (1979) and McElroy (1977).